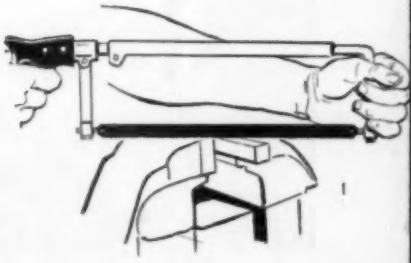
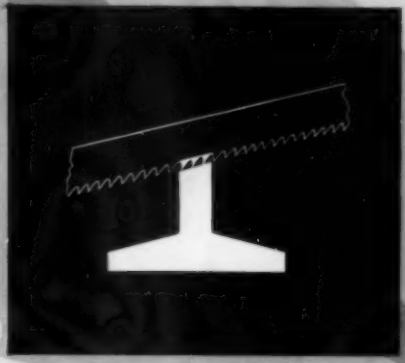
Machine and Tool
BLUE BOOK

A Hitchcock Publication

JULY · 1960





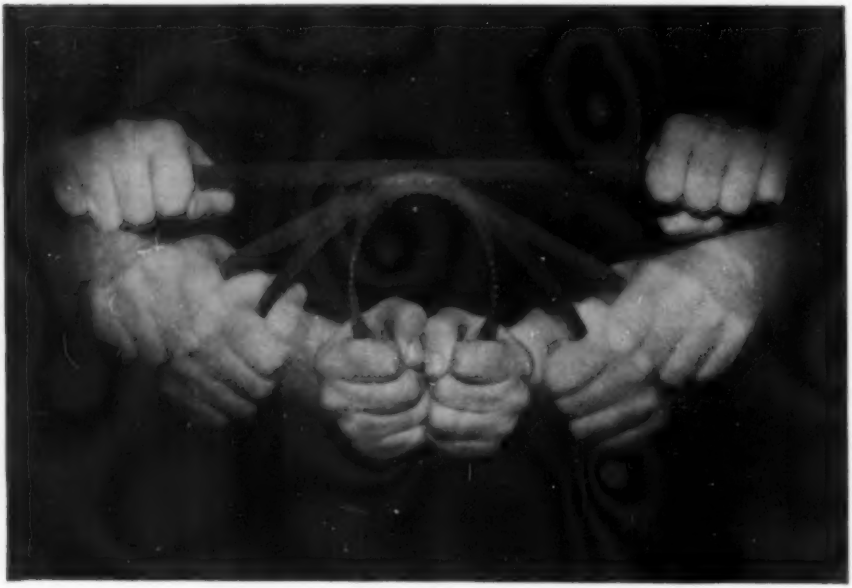
HACKSAW BLADES

Proper Selection And Use

ALSO IN THIS ISSUE:

Latest Trend In Transfers

Put Them On Wheels!



So it doesn't break---*So what??*

So we can bend a MARVEL High-Speed-Edge Hack Saw Blade double, and it won't break. Does this prove anything?

Let's see if it does. When you buy a box of hack saw blades, you expect each blade to have a reasonable cutting life. For example, take an ordinary blade that costs $4.00, and you expect it to produce 2000 sq. inches of accurate cutting-off before it is discarded. Would you be willing to pay $8.00 for that same blade? *You will, if it breaks halfway through its expected life.*

Bending a MARVEL High-Speed-Edge Hack Saw Blade to demonstrate that it is truly unbreakable proves the point that you get every square inch of blade life you pay for when you buy MARVEL Blades.

Safety to both operator and machine, plus maximum blade life, seem like value enough from this remarkable blade. However, these MARVEL Blades give you even more, for they will cut faster, with greater accuracy because they can be safely tensioned more taut in your machine than ordinary "breakable" blades and are therefore more rigid to resist deflection.

Cost? Unbreakable MARVEL High-Speed-Edge Hack Saw Blades are priced competitively. Use MARVEL Blades consistently with complete confidence because they have no equal for value. Leading Industrial Distributors stock and sell MARVEL. Ask yours today.

MMT-PE

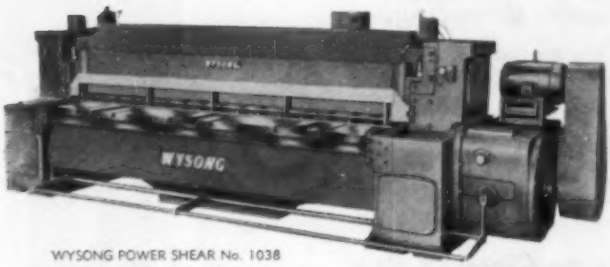
ARMSTRONG-BLUM MANUFACTURING CO.
5700 West Bloomingdale Avenue • Chicago 39, Illinois

MARVEL Metal Cutting SAWS

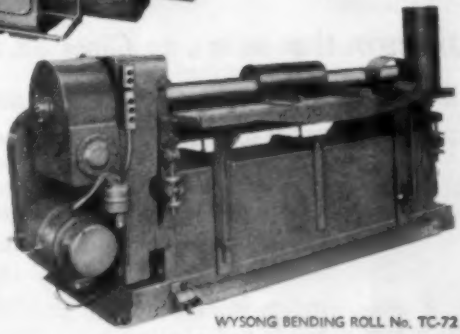
See America's finest SHEARS and BENDING ROLLS

Visit WYSONG BOOTH No. 1149 MACHINE TOOL EXPOSITION 1960

You are cordially invited to visit our booth while attending the Machine Tool Exposition in Chicago September 6-16. We want you to compare Wysong shears and rolls with other well-known makes on display. Compare design . . . feature for feature . . . value for value . . . and you'll understand why so many users of Wysong machines say: "buy a Wysong . . . it's Miles ahead"



WYSONG POWER SHEAR No. 1038
Capacity 3/16" x 10'
Other models available with cutting lengths from 24" thru 12', capacities from 16 gauge thru ½".



WYSONG BENDING ROLL No. TC-72
Models available with roll diameters of 4¼", 5", 6", 7", 8" with working lengths from 36" thru 10'.

WYSONG

WYSONG & MILES COMPANY
615 Fulton Street
Greensboro, N. C.

Use postpaid card. Circle No. 201

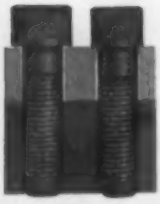
ALLEN

The cost of ALLEN Hex-Socket Cap Screws is only a minor fraction of your assembly costs... be sure you're getting the time-saving, cost-saving advantages of *genuine* Allens!

Ever since Allen first produced the hex-socket head screw fifty years ago, specifying *genuine* Allens has been a sure way to guarantee dependable threaded fastening. Just look at these features...

- **Leader Points** make starting easier... greatly minimize danger of cross threading.
- **"Pressur-Formd"** to preserve the long fibers uncut throughout the length of the socket—assuring stronger sockets for greater tightening torque.
- **Exclusive Allen** heat treatment for added toughness.
- **Uniform threading** to Class 3A fit.

Write for samples and engineering data. See how *genuine* Allens will make your product better.



NEW! Allen '60 Series Socket Head Cap Screws have larger heads and sockets... give up to 2⅓ times more load-carrying capacity. Write for new Bulletin G-25, with full specifications.

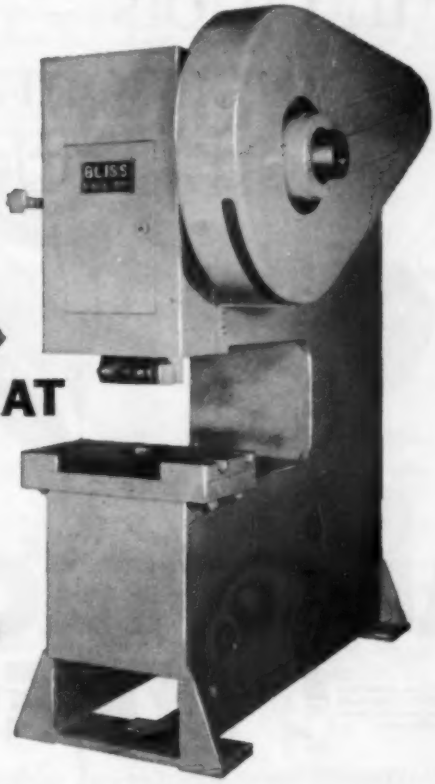
50 ANNIVERSARY YEAR ALLEN HEAD 1910-196

ALLEN MANUFACTURING COMPANY
Hartford 1, Connecticut, U.S.A.

NEW

line of Bliss presses featuring

DEEP THROAT



All moving parts are interchangeable with standard inclinables

Rugged, compact, these reinforced welded steel frame presses are designed to give maximum rigidity and minimum "spring" under load.

All moving parts enclosed for greater safety—yet instantly accessible for adjustment. Probably most important is that these parts are *standard* Bliss inclinable press parts. This means you can be sure of quick parts service wherever you're located!

Sizes range from 4-ton bench models with a 12" throat to a 60-ton press with a throat almost three feet deep. You can also have extended bodies, mechanical or air friction clutches, automatic lubrication, other features. Why not write for details.

BLISS SINCE 1857

is more than a name . . . it's a guarantee!

E. W. BLISS COMPANY · Canton, Ohio

Use postpaid card, Circle No. 203

Fine tools that encourage Good Work

ARMSTRONG WRENCHES

If you don't know your local ARMSTRONG Distributor, we will send you the names of those in your area.

An ARMSTRONG Wrench feels right—is balanced. It goes over nuts or screw heads easily, grips firmly without sloppiness, won't round corners—because openings are carefully machined to correct sizes. It's safe, strong beyond need without clumsy bulk—because of superior design and selected steels, heat treated to proper degree of hardness and tensile strength. It's quality finished, ARMALOY (alloy steel) Wrenches in chrome plate with heads buffed; HI-TEN (carbon steel) Wrenches in baked-on gray enamel with heads ground bright . . . all plainly marked for size. All are uniformly excellent tools manufactured under strict quality control, by modern methods, with modern equipment in a modern tool plant . . . 1537 different industrial sizes and types —single wrenches, or sets in metal cases, boxes or rolls . . . each a quality tool. Armstrong Wrenches are "Fine tools that encourage good work."

ARMSTRONG BROS. TOOL CO. 5208 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.

SEE US AT BOOTH 238 PRODUCTION ENGINEERING SHOW SEPTEMBER 6-16 NAVY PIER CHICAGO, ILLINOIS

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JULY, 1960 Vol. 55 No. 7

Machine and Tool BLUE BOOK

BPA

Published Monthly by Hitchcock Publishing Company, Wheaton, Illinois. Printed in U.S.A., Subscription rate is $5.00 per year in U.S.A., $6.00 per year elsewhere

NOW! for the FIRST time HYDRAULIC FEED on a 10" x 16" grinder

LOW COST
Micro-Precision, High Speed Grinding

No. 17H
Priced at only
$3580.00
to give you the operating ease and high speed of hydraulic feed for little more than the cost of a hand feed grinder.

For precision surface grinding on tool room or production jobs, you can't beat the Covel No. 17H. The large grinding wheel with plenty of direct power *plus* high speed hydraulic feed and big cross-feed capacity make it a real money saver. *Grinds approximately twice as fast as with a comparable hand feed machine.*

First with hard chrome table ways...
Preserve original accuracy of hand-scraped V and Flat tableways. Available at extra cost on all Covel Surface Grinders.

Micro-Precision a Covel Tradition-Since 1874

COVEL PRECISION GRINDERS
BENTON HARBOR, MICHIGAN

Write, wire or call us TODAY. We'll gladly show you what the Covel 17H can do for you. Ask for Bulletin BB-70.

Use postpaid card. Circle No. 285

FOR JOB SHOPS OR
LINE PRODUCTION

JUST DIAL CORRECT SPEED

FOR EVERY STOCK

Speed flexibility assures smooth cut . . lengthens blade life. Precision engineered and ruggedly built of steel plate and cast iron.

Automatic Power Feed available.

Model 87
20" Band Saw

Change Blade Guide Inserts in 60 Seconds!

WRITE FOR FULL DETAILS NOW! DEALERS IN PRINCIPAL CITIES

POWERMATIC®
MACHINE COMPANY Dept. 2
McMinnville, Tennessee

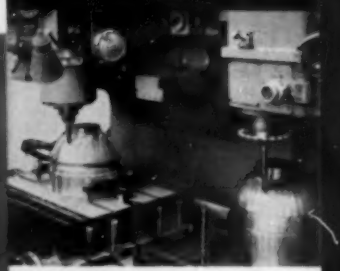
Use postpaid card. Circle No. 206

Here's what the **CINCINNATI**

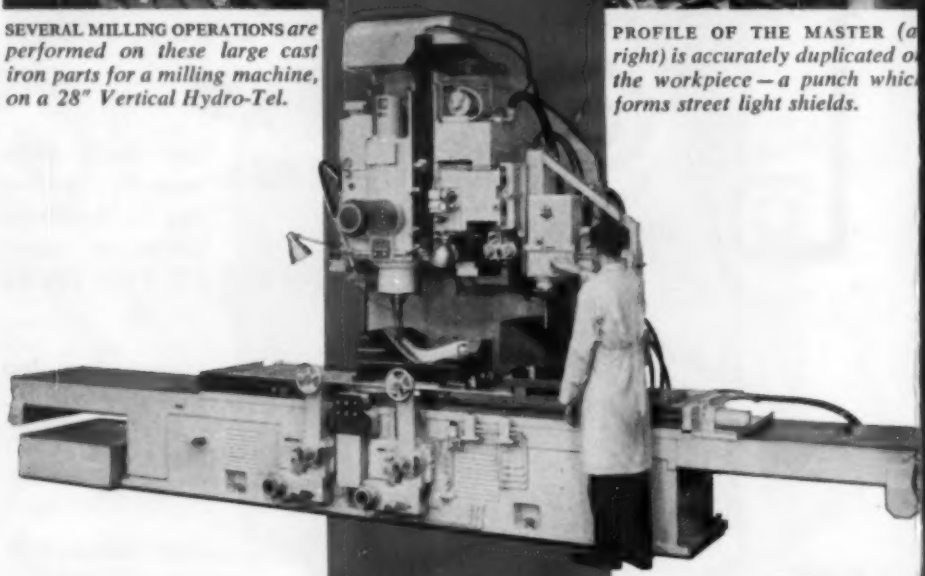
general-purpose milling

SEVERAL MILLING OPERATIONS *are performed on these large cast iron parts for a milling machine, on a 28" Vertical Hydro-Tel.*

automatic profile tracing



PROFILE OF THE MASTER *(a right) is accurately duplicated o the workpiece — a punch whic forms street light shields.*



CINCINNATI 30"x96" Ver... ...ical Hydro-Tel Millin... Machine. Catalog No M-1923-2.

MMT-PE

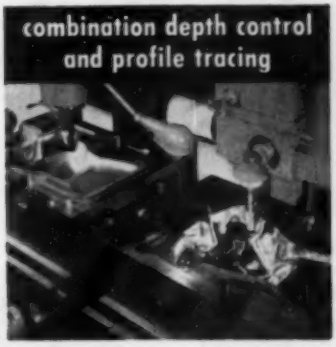
Booth No. 1034

BUILDERS OF FINE MACHINE TOOLS: KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES •

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

HYDRO-TEL *can do for you...*

DIE FOR AUTOMOBILE ARM REST *is cut on a 30" Hydro-Tel (see large illustration on left page).*



COMBINATION TRACING *of a life-size dress form mold on a 28" Hydro-Tel. This complex part is completed in a single setup.*

For lower costs and greater productivity consider the versatile Hydro-Tels. Basically, these machines are flexible general-purpose millers, rigidly constructed and powered to take a healthy cut. Features include hydraulic activation of all slides, with finger-tip touch manual servo controls; infinitely variable, independent feed rates for table, cross-slide and vertical head (if desired); single lever directional controls for feed and rapid traverse of table and cross-slide; dial selection of spindle speeds. All controls are within convenient reach from the operating position.

Hydro-Tels are even more than efficient general-purpose milling machines: when equipped with standard tracer units they meet the highest requirements of die sinking and production shops. Automatic depth control tracing, 360° automatic profiling and various combinations of these two methods simplify accurate reproduction of the most complex shapes. And a wide array of multiple spindle heads are available to suit your machining operations and production schedules.

Let our Field Engineers explain what CINCINNATI Hydro-Tel Milling Machines can do in *your* shop. For further information write for Catalogs M-1773-3 and M-1923-2.

ER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

CINCINNATI
MILLING MACHINE DIVISION

Use postpaid card. Circle No. 207

1

Unlocked position • In this position tools are inserted or removed.

2

Locked position • Handle is moved upward as shown to lock tools securely. Desired locking pressure obtained by nose adjustment.

3

Working position • Tool now securely held in position—handle removed.

TREE RAPID-LOK COLLET ADAPTER

EXCLUSIVE TREE FEATURE

The Tree Rapid-Lok is a collet adapter designed to hold end mills, boring bars, and other tooling *accurately, securely* and *with great rapidity* on both horizontal and vertical mills, jig borers, boring bars and other machines.

It is an adaptation of an exclusive feature which has been proved in use on Tree milling machines over a period of years.

For Full Information Write

TREE TOOL & DIE WORKS

RACINE, WISCONSIN

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How to get better production from your Brown & Sharpe grinders . . . . . .

Now you can grind square shoulders and produce very fine chatter-free finishes with Whitnon precision spindles made for Brown & Sharpe #1, 2, 3, 4 and 11 Universals. Precision ball bearings with a heavy fixed preload prevent end-shake. Grease lubricated and sealed, they require no maintenance for long trouble-free life. Flat belt or multiple V-belt pulley styles are available.

For internal grinding on B & S #2, 3 and 4 Universals, a hefty Whitnon offset bracket takes any 3 inch diameter spindle such as Whitnon's C-214 series, which uses tandem precision bearings, spring-preloaded, with sealed grease lubrication for speeds to 15,000 rpm, oil lubrication to 25,000 rpm.

High performance Whitnon spindles are available for B & S #2 and 5 surface grinders, and for #10 and 13 tool and cutter grinders. Also available, Whitnon high speed attachment for small contour grinding at wheel speeds up to 22,000 rpm on 6 x 18 surface grinders.

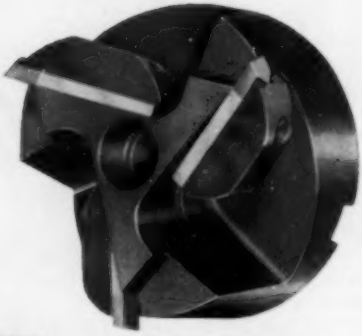
Whitnon's new catalog #59M lists hundreds of high performance precision spindle ideas. Ask for your copy.

The Whitnon Manufacturing Company
Route 6 and New Britain Avenue
Farmington, Connecticut ... ORchard 7-2607
Specialists in the design and manufacture of precision spindles. Custom builders of precision rotary machinery for use in computer drums, plywood routers, glass fiber spinners, synthetic fiber rolls.
Expert spindle repairs at Farmington and at Whitnon Spindle Co., 20466 Wyoming Avenue, Detroit, Mich.

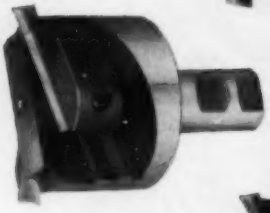
NEW Manchester MILLING CUTTERS

OFFERS . . .

- ★ CARBIDE INSERTS
- ★ SHEAR CUT ACTION
- ★ MORE USEABLE CARBIDE
- ★ IT'S ECONOMICAL TO BUY AND MAINTAIN
- ★ QUICK SETTING GAGE INCLUDED



M-50
5" dia. cutter (with 1-½" dia. pilot hole) 3, ⅜" wide carbide inserts



M-35
3-½" dia. cutter, 1-¼" dia. shank, 2 carbide inserts ¼" or ⅜" wide

M-25
2-½" dia. cutter, ¾" or 1" dia. shank, 2 carbide inserts ¼" or ⅜" wide

The new Manchester P.D.Q. Milling Cutters are made of heat treated alloy steel and are designed to handle the "tough jobs". Inserts may be changed in the machine. Exclusive double "V" clamp automatically registers the cutting tools. Designed for low H.P. machines. Special shanks available on request. Write for literature.

PORTAGE Double-Quick, Inc.

1037 SWEITZER AVENUE • AKRON 11, OHIO

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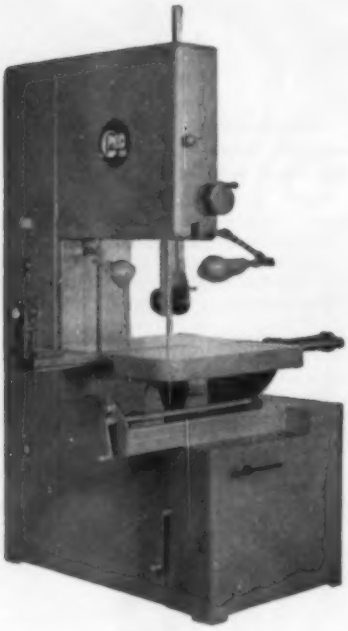
GROB SPELLS THE DIFFERENCE IN BAND SAW MACHINES

The new GROB 24" universal band saw
has all the famous GROB features:

Quality • Efficiency • Durability • Strength
Utility • Low Maintenance • Reasonable Cost



- Speeds infinite from 35-12000 FPM covers both cold and hot sawing
- Variable drive 3-speed transmission with precision rolled gears and splines transmits 15 HP
- Hydraulic table feed

See the difference demonstrated in our dealers' showrooms

or

Write GROB INC. for complete specifications

GROB also manufactures a complete line of:

BUTT WELDERS
FILING MACHINES
GEAR ROLLING MACHINES

GRAFTON, WISCONSIN

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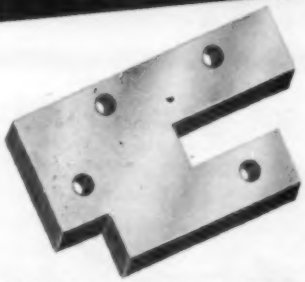
MACHINE TOOL

MARKING TOOL

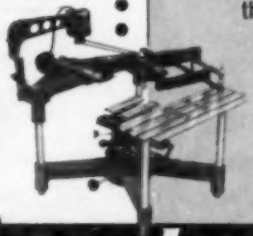
ENGRAVOGRAPH is both!

"The skill is in the tool, not on your payroll"



Vertical Milling...Profiling...Slotting ...Drilling: With Engravograph, this shape was profiled and the holes were spotted and drilled in one set-up, from one master template, eliminating expensive tooling, multiple operations on costly equipment.

MAKE IT IN A FRACTION OF THE TIME



Engraving Nameplates...Marking parts and panels: With Engravograph, any nameplate, panel or tag can be engraved right in your own shop, thereby eliminating much unnecessary subcontracting.

MAKE IT WHEN YOU NEED IT

Write on your letterhead for 28-page catalog MM-4.

new hermes

ENGRAVING MACHINE CORP., 154 W. 14th ST., NEW YORK 11, N. Y.

IN CANADA: 359 St. James Street West, Montreal, P. Q.

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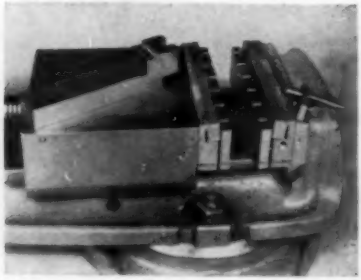
J&S TOOL CO., INC.

You get day - in with J & S

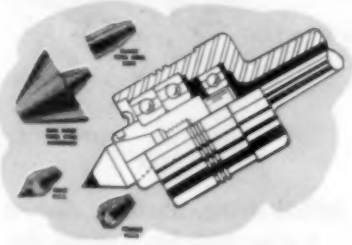
1. VISE JAWS— ADJUSTABLE & DOWN-HOLDING

Sturdy, effective vise jaws which are interchangeable. May be used with most conventional milling vises.



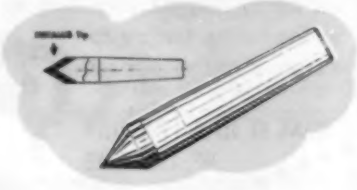
2. DETACHABLE POINTS

Selection of detachable interchangeable points. For use with J&S's guaranteed live centers for lathes.



3. SOLID CENTERS

With METALUB tips. Select from stock centers to your individual requirements.



Use postpaid card. Circle No. 214 for item 1; 215 for item 2; 230 for item 3.

day - out economy
precision - crafted products

ADJUSTABLE DOWN-HOLDING VISE JAWS

These unique down-holding vise jaws are interchangeable and are adaptable to conventional milling vises, with the same features as the J & S milling vises.

The special adjustment screw minimizes or cancels the contact of the serrated jaws with the workpiece. Spring-attached parallels (hardened and ground) remain in place, thus keeping the cleaning between parts to a minimum. For vises with jaw depths of 2" or more.

DETACHABLE POINTS FOR J & S LIVE CENTERS

Accurate, interchangeable, these detachable points are available as separate items for use with J & S' famous live centers for lathes: the Standard S Type, Heavy Duty H Type, Extra Heavy Duty X Type, Expansion Compensator L Type, and Extra Capacity Expansion Compensator LX Type. Points shown at left are Female H.S.S., Blank Tool Steel Soft, Male H.S.S. and Bull Nose Tool Steel Hardened. Carbide tip mounted in spindle.

SOLID CENTERS FOR LATHES & GRINDERS

J & S has available an extensive line of high quality solid centers made with METALUB tips. METALUB has a lower coefficient of friction; it resists wear on an average of seven times better than high speed steel. We will also make special solid centers to your individual specifications.

Literature and data on request,

specify product No. listed opposite illustration.

J&S TOOL CO., INC.

882 DORSA AVE., LIVINGSTON, N. J.

WYman 2-3181

NOW—SINE PLATES FROM EX-CELL-O!

EX-CELL-O ADDS ROBBINS MAGNA-SINE TO LINE OF PRECISION GAGE AND INSPECTION EQUIPMENT

Magna-Sine and non-magnetic sine plates, formerly manufactured by the Omer E. Robbins Company, are now part of the famous Ex-Cell-O line of precision inspection, gaging, and machining equipment.

With Ex-Cell-O Magna-Sine you set up any angle, single or compound, right or left hand, without V-blocks, angle plates, or complicated "build-ups". Just select the proper gage blocks, place them between the base and roll bar swivel block, flip the locking device . . . and you're ready to go! And Ex-Cell-O Magna-Sine holds work securely—without clamps—by the most powerful holding force ever built into a permanent chuck magnet.

Ex-Cell-O sine plates are available in a complete range of sizes and models, magnetic and non-magnetic, for every machining and inspection operation.

New Ex-Cell-O 90° Indicator Gage

For faster, easier, precision checking of squareness, use the new Ex-Cell-O 90° Indicator Gage—plus or minus accuracy to .0001" is instantly registered on its dial gage. Surfaces up to 17¾" long can be checked with each reading. Also, when used with Ex-Cell-O precision sine plates, this time-saving indicator gage will quickly measure the accuracy of angles other than 90°.

The Machine Tool Exposition—1960

MMT-PE

See Ex-Cell-O In Booth 946

J-6862

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

XLO

EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

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UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel—the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.

213

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck

Standard Collet Chuck

Mikro-Lok Boring Bar

Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing

Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 10, MICHIGAN

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ANNOUNCING

NEW GISHOLT 3F FASTERMATIC WITH *FeeDial* CONTROL

IN JUST 15 MINUTES!

...then set your tools and take your trial cuts. That's how fast and simple it is to set up the new Gisholt MASTERLINE 3F FASTERMATIC Automatic Chucking Turret Lathe!

Only 15 minutes to pre-select feeds, speeds and functions—Now the desired feed rate is individually selected for each tooling station by turning a dial control. Selection of spindle speeds and machine functions is equally fast—just flick toggle switches. You do it all in just 15 minutes.

Completely automatic—But your savings don't end with fast setup. The automatic cycle assures consistent quality at fixed production rates. Any operator, even a new man, can chuck the work, start the cycle and remove the finished part. He has ample time to handle another machine.

What's more fast setup makes the new 3F pay off big on machining small lots—25 to 50 pieces—as well as long production runs. Contact your Gisholt Representative, or write us.

Send for literature—Ask your Gisholt Representative to show you how this new 3F with FeeDial can cut costs on your work.

GISHOLT

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

Turret Lathes • Automatic Lathes

• Balancers • Superfinishers • Threading Lathes

• *Factory-Rebuilt Machines with New-Machine Guarantee*

Investigate Gisholt's Extended Payment and Leasing Plans

Use postpaid card. Circle No. 219

SYNTRON

VERTICAL - VIBRATORY

PARTS FEEDERS

handle parts at high hourly rates–

. . . replace manual methods of handling small parts . . . handle parts of almost every size, shape and material at high instantly controlled rates to tapping, counting, inspecting, tooling, centerless grinding, stamping machines, and other operations.

SYNTRON Parts Feeders offer dependable, high count, single file feeding of parts. Designed for efficient, dependable service with little or no maintenance.

Write for free literature on SYNTRON Parts Feeders

SYNTRON COMPANY

300 Lexington Ave. Homer City, Penna.

Use postpaid card. Circle No. 220

NOW! PUNCH BOTH ROUND AND SHAPED HOLES WITH ONE UNIT

New STRIPPIT "CJ" *combines the best features of all other punching units, yet it costs no more than ordinary round-hole units.*

Here's greater versatility than ever before in a self-contained hole punching unit. STRIPPIT "CJ" holders and die bases are keyed to take shaped parts. And you pay no more for the "CJ" unit than any competitive round hole unit.

If your current metalworking requirements call for round holes in anything up to ¼" mild steel, the STRIPPIT "CJ" fills the bill. But let's say you get a future job that requires obround, square or rectangular holes. Simply substitute the proper shaped punches, punch guides and die buttons. They're always in stock. You save the cost of a complete new unit or the inconvenience of returning your existing unit to the factory for keying.

Of course you get the same quality which has made STRIPPIT famous for 35 years. Holders are metallurgically correct for their punching range. And a far superior one piece shoulder head punch is standard in both the round and shaped series.

Write now for full information and prices on the new, time-saving, money-saving STRIPPIT "CJ".

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A UNIT OF HOUDAILLE INDUSTRIES, INC.

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In Canada: Strippit Tool & Machine Company, Brampton, Ontario.

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valve body machining time cut

BURGMASTER

3/4" Capacity in Steel

Schurz Controls Corporation, Los Angeles, California, completely machine Water Softener Valve Bodies at a record rate of 3¼ minutes per part using one man on a Burgmaster Turret Drill. Formerly, five men were employed on Turret Lathe and Drill Press equipment requiring 36 minutes per part on a per man basis. The Burgmaster Machine setup has also overcome the problems of holding critical dimensions that had resulted in numerous rejects and reworking by former method.

The speed and flexibility of the Burgmaster Turret Drilling Machine are illustrated in this operation which includes 3-step core drilling (1.130" dia. max.), 2" spotface, tapping, die cutting OD threads, hollow milling, drilling and reaming. The six spindle turret quickly power indexes to bring a series of tools into operation at one station. This method is faster and more accurate since it eliminates waste motion and prevents many resulting errors of relocation. Spindle speeds and depth of cuts are individually preselective and automatically shift with turret indexing.

Joe Berger, Superintendent, says, "The Burgmaster Machine gives us six spindles in ⅓ the space. Because of the Machine's greater accuracy and speed, we wouldn't be without it."

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from 36 to 3¼ minutes on

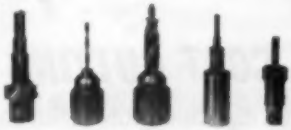
Model 2B Six Spindle Turret Drill

(at Schurz Controls Corp., Los Angeles, California)

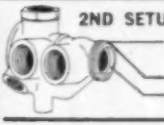
HOW THE JOB IS RUN

1ST SETUP — .80 MINUTES PER PART

Spindle No.	Operation	Tool	Speed rpm
1	Core Drill	3-step core drill with 2" spotface	700
2	Drill	#F	650
3	Drill	3-step drill	700
4	Ream	3-step reamer	1300
5	Tap	½-20 tap with Burgmaster Tapping Head	350

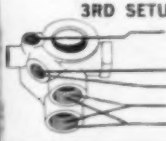


2ND SETUP — .58 MINUTES PER PART

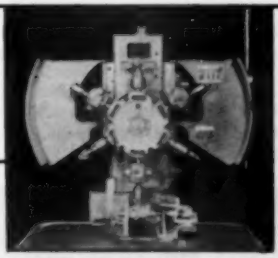


1	Mill	Hollow Mill for 1" OD straight pipe thread	700
2	Thread	Die cut 1" pipe thread	225
3	C'bore, Face	Form cutter	700

3RD SETUP — 1.85 MINUTES PER PART



1	Port	¼ Pipe Tap Form Tool	700
2	Tap	¼ Pipe Tap	225
3	Port	⅜ Pipe Tap Form Tool	700
4	Tap	⅜ Pipe Tap	225
5	Port	¾ Pipe Tap Form Tool	700
6	Tap	¾ Pipe Tap	225



Close-up shows how six Burgmaster spindles are used in third setup to form machine port contours and pipe tap five holes radial to main bore. Fixture locates on both ends of main bore, permitting indexing of part for proper hole alignment. Total machining time for 18 operations during three setups is 3.23 minutes compared to 36 minutes per part required when using a five man crew on turret lathe and drill press equipment.

Write for free bulletin describing Burgmaster 6-Spindle Model 2B Turret Drill with power indexing turret, preselective spindle speeds and preselective depth control, also 16MM sound film showing machines in operation, including the new automatic tape controlled machine available from any office.

JOB FACTS

Machine: Burgmaster 2B Six Spindle Turret Drill.

Company: Schurz Controls Corporation, Los Angeles.

Part: Valve Body for Water Softener.

Material: Commercial Red Brass Casting.

Quantity: Lots of 1000.

Holding: Toggle-clamped positioning fixtures.

Tooling: Carbide tipped special tools; HSS standard drill and taps.

Present Time: 3.23 minutes per part average floor to floor time, increasing production over 1000%.

Former Time: 36 minutes per part.

Advantages: 1000% production increase in ⅓ the floor space — greater accuracy — less operator fatigue.

Power Feed Attachment Available

World's Largest Builder of Turret Drilling Machines

"O" Manual Power Index ¼" Capacity

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ⅜" Capacity

28B Ram Type Radial Drill ¾" Capacity

28H Automatic Hydraulic ¾" Capacity

28H Automatic Hydraulic 1½" Capacity

2SAH Automatic Tape Controlled 1½" Capacity

2SHT-3SHT Automatic Tape Controlled ¾" and 1½" Capacity

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us dealer representatives in other industrial centers.

HEAVY RECTANGULAR TUBES—accurately formed on Pines Model 6 on a 24" inside radius for air cushion assembly on heavy duty truck chassis. Material is 4" x 9½" x .500" wall.

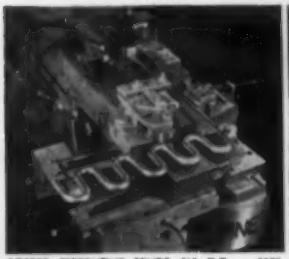
SOLID STEEL BEAMS—cold edge bending of 5½" x 1⅛" steel bars on Pines Model 4 replaces hot bending on dozer, produces more accurate parts at lower cost for road machinery manufacturer.

ALUMINUM CHANNELS—rugged machine construction and tooling on Pines Model 3 Machine cold forms 4" x 1⅝" x .330" aluminum channel without wrinkling or distorting. Spring-back is controlled by simple machine settings.

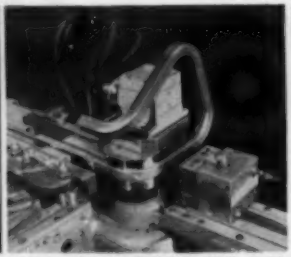
FOR COST CUTTING IDEAS

INVESTIGATE PRODUCTION BENDING THE "PINES-WAY"

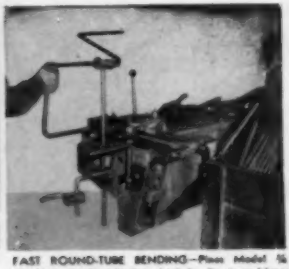
When you have a production job requiring the cold forming of parts from round, square, rectangular, extruded, or hollow stock to an even radius, or to different angles, we suggest you investigate the cost cutting advantages of production bending the Pines-way. The examples shown here illustrate a few of the many different and varied applications which are today profitably produced on Pines machines. Cold bending is a fast, accurate, easy to control metal forming process that is today more profitably applied in the production of an ever increasing variety of products. Call on Pines engineers for assistance without obligation on any specific job.



COPPER SERPENTINE BENDS—⅜" O.D. x .035" copper tubing is rapidly formed on this Model ⅜ into serpentine coils on a 1" ctr. A simple gang-slitting operation produces 180° return bends.



WRINKLE-FREE SQUARE TUBE BENDING—Model 1 Machine, equipped with flexible mandrel and self-opening bending form, produces top quality office and hospital equipment at speeds of 250 bends per hour.



FAST ROUND-TUBE BENDING—Pines Model ⅝ Machines speed production of tubular dinette and lawn furniture. Fast, automatic cycling and accurate progressive bending produce 600 to 900 bends per hour.

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Specialists in Tube Fabricating Machinery

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To keep abreast with bending, write for free copies of "Pines News" — gives complete data on new production applications.

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

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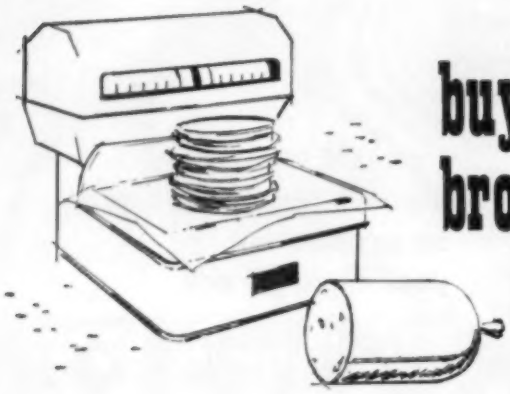
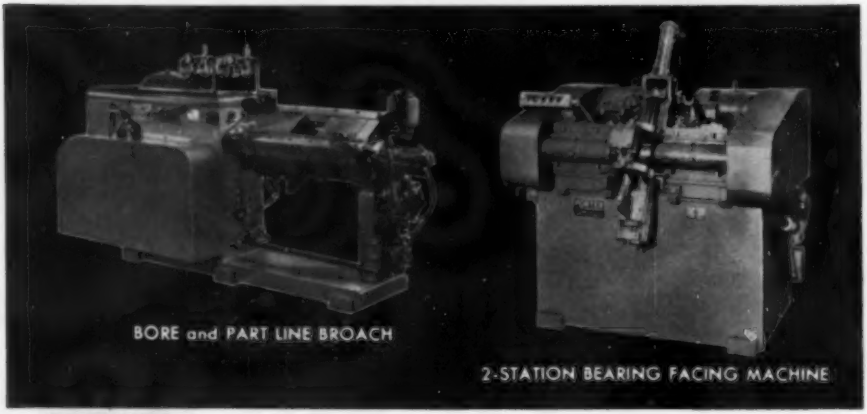


buy broaching by the pound ?

Prominent bearing manufacturers have found that they get more for their money with Porter Broaching Machines. Not only is the initial investment much smaller, but these machines maintain production and tolerance requirements with less down-time than most other bearing broaches. Buying broaching by the pound makes sense . . . adds up to important dollars when the Broach Machine is from C. O. Porter.

C. O. Porter has manufactured precision machinery for over 75 years. This experience has been put to effective use in the production of this quality line of Broaching Machines. Write for detailed information.



C. O. PORTER machinery company

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That's why a NORBIDE dressing stick gives you such easy, free-hand control when you're truing a wheel face, dressing a knife edge, forming a radius. The extra hardness eliminates dust . . . assures top accuracy with your lightest touch . . . and means extra long, extra low cost service life. Order your NORBIDE dressing stick today or write for Form 1567, NORTON COMPANY, General Offices, Worcester 6, Massachusetts.

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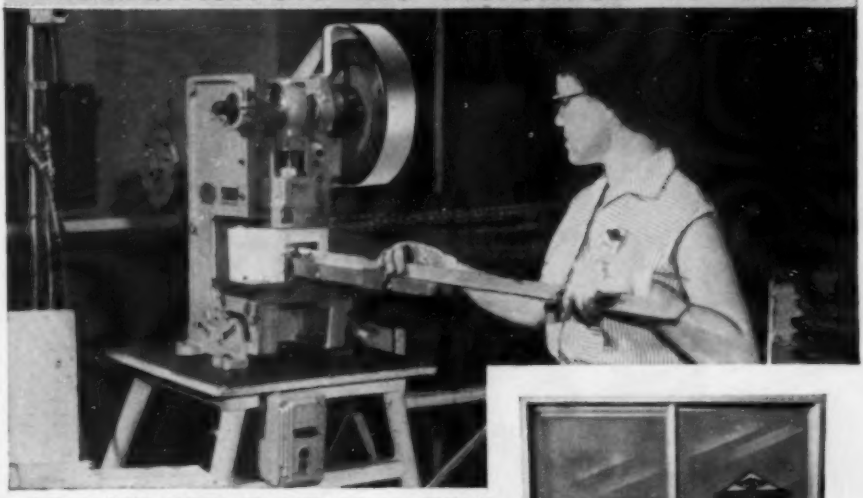
KENDALL-ADDINGTON STANDARDIZE ON KENCO PRESSES..... die life increased 10 times



THIS 5 TON PRESS IS ONE OF 21 KENCO PRESSES THAT PIERCE, NOTCH AND SHEAR ALUMINUM WINDOW COMPONENTS TO THE PRECISION NEEDED FOR PROPER ASSEMBLY.

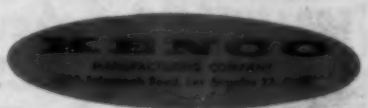
Kendall-Addington of Fresno, California, leading manufacturer of unitized aluminum windows, have standardized on Kenco by adding 21 of these cost-cutting Presses in their punch press department. Comparative tests since 1958 have shown that Kenco Presses increase die life up to 10 times and also eliminate former mechanical difficulties requiring major press maintenance. Complete replacement of other presses with Kenco equipment is paying off at Kendall-Addington through substantial reduction in production costs.

Why not get all the facts about the advantages of Kenco construction?—greater rigidity, precision and reliability that save your dies and make press time more productive. A Kenco representative will be glad to discuss your requirements at no obligation.

(Write for Kenco literature) giving complete press specifications.

also 18, 21 and 26 tons capacities

THE MOST COMPLETE LINE OF SMALL PUNCH PRESSES IN THE WORLD



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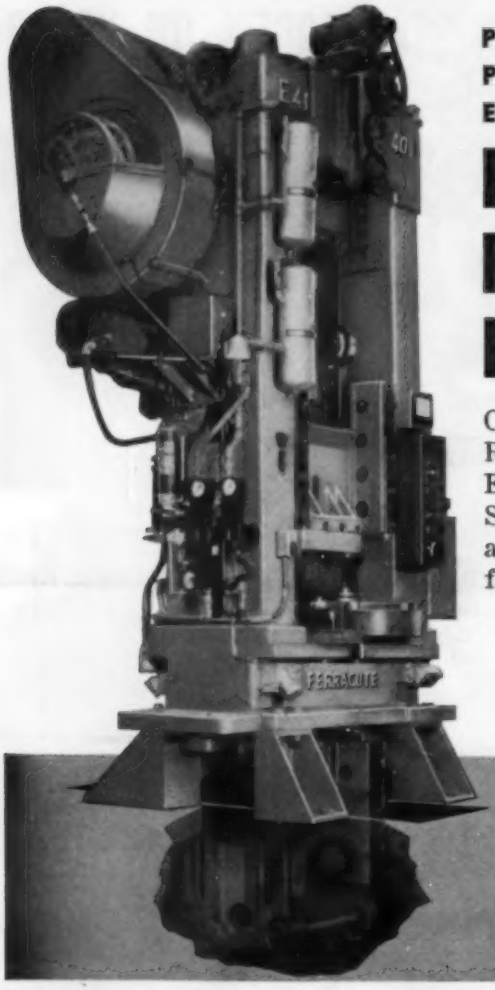
FERRACUTE NO. E-401
400-TON RESTRIKING PRESS
with 100-ton bottom ejecting mechanism.



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Ferracute Restriking Presses

Check this new Ferracute Restriking Press. Efficient, economical. Standard sizes: 150-, 250-, and 400-ton. Larger sizes for special requirements.

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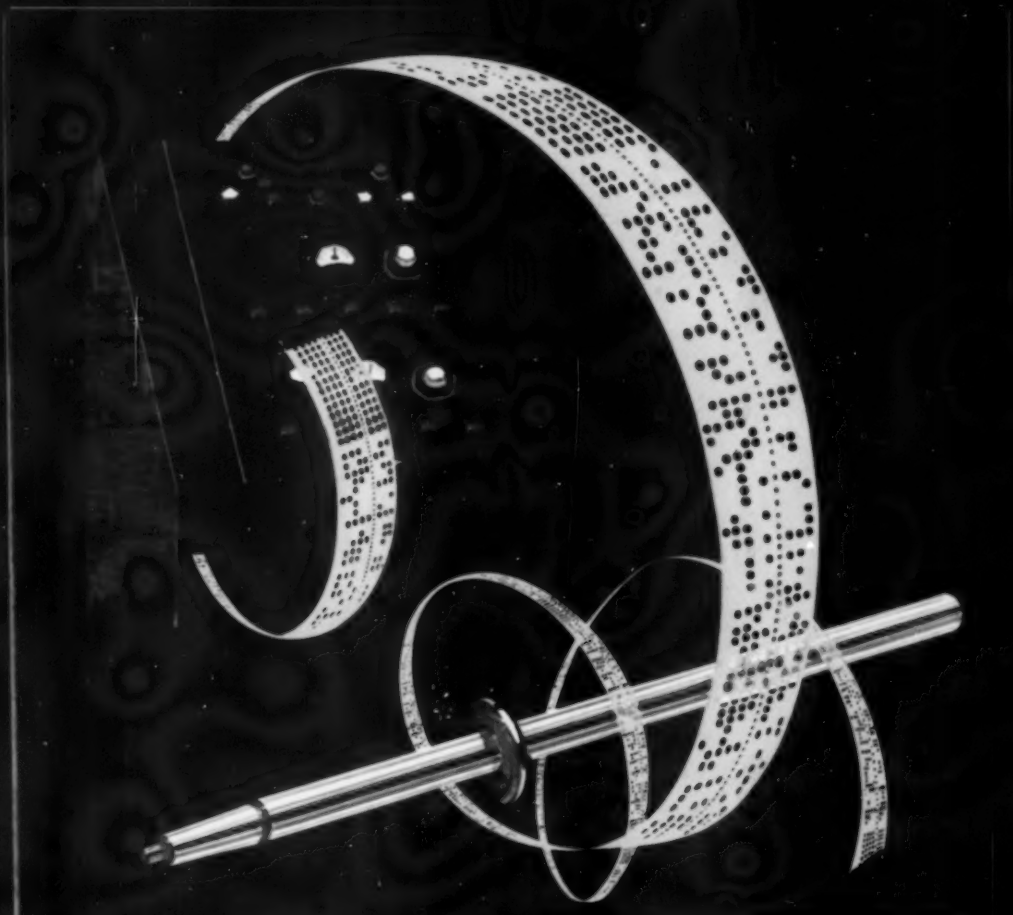
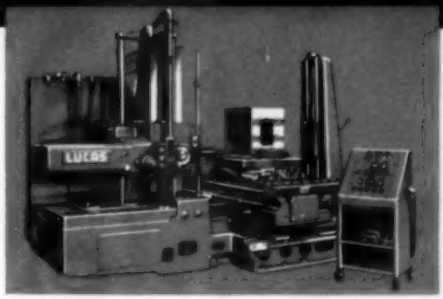
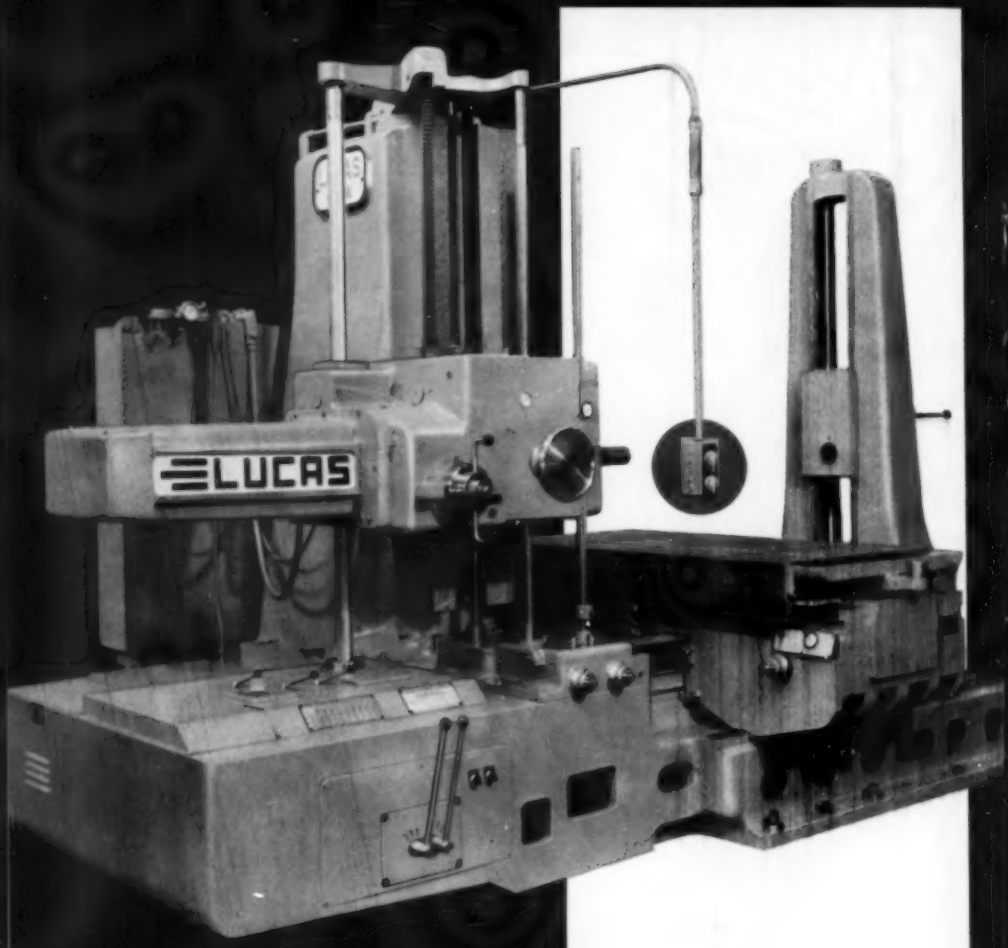


Tape control... certainly!

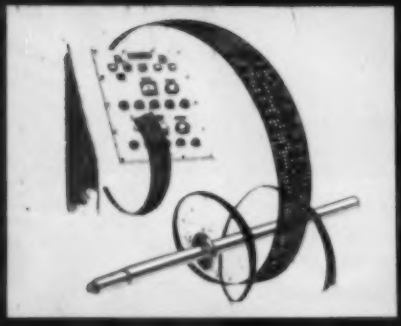
Tape control can readily be applied to any Lucas model, (2-3/4" to 6" diameter spindles) if repetitive operations or complicated one-of-a-kind jobs make this new development advantageous. Lucas tape controlled machines are available with punched tape for N.P.C., magnetic tape for contouring, or tape and tracer control. If you have a profitable use for *any* type or size of horizontal boring, drilling and milling machine (up to 6" spindle capacity) you can get it at its best from the specialist in this type of machine. *Did you ever meet a man who regretted picking a Lucas?*



LUCAS
OF CLEVELAND



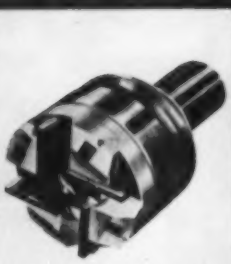
Simplified pendant controls . . .



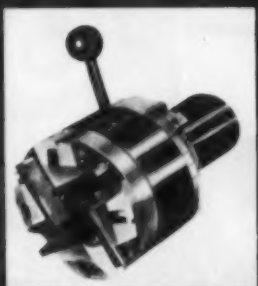
A Lucas performs the greatest variety of operations possible in any machine tool. Standard models permit control of *all* operations from the pendant. Optional pendant and lever control machines, like the one shown above, combine a simplified pendant with readily accessible levers. Whichever type of control you want—pendant, lever, tape, tracer or any of these in combination—Lucas has it.

LUCAS
OF CLEVELAND

SHOW OFFS...



REVOLVING & STATIONARY TANGENT DIE HEADS



RADIAL DIE HEADS

REVOLVING & STATIONARY COLLAPSIBLE TAPS

SOLID ADJUSTABLE TAPS

MODERN MAGIC CHUCKS AND COLLETS

. . . and where they really show off is on the production line!

These tools don't belong in a showcase. They're beautifully made, to be sure, but they're made for *work* — all kinds of work. All J&L thread tools guarantee Class III threads or better, *every time*, through a system of "no approximations." They give long chaser life, foolproof resharpening, and extremely low cost per piece. What's more, they are backed up by the world's most modern thread tool plant, have world-wide distribution outlets, and are augmented by a trouble-shooting team of seasoned field engineers.

Let us help you with your threading operation so trouble won't crop up.

JONES & LAMSON THREAD TOOL DIVISION

JONES & LAMSON MACHINE COMPANY, 520 Clinton St., Springfield, Vt., U. S. A.

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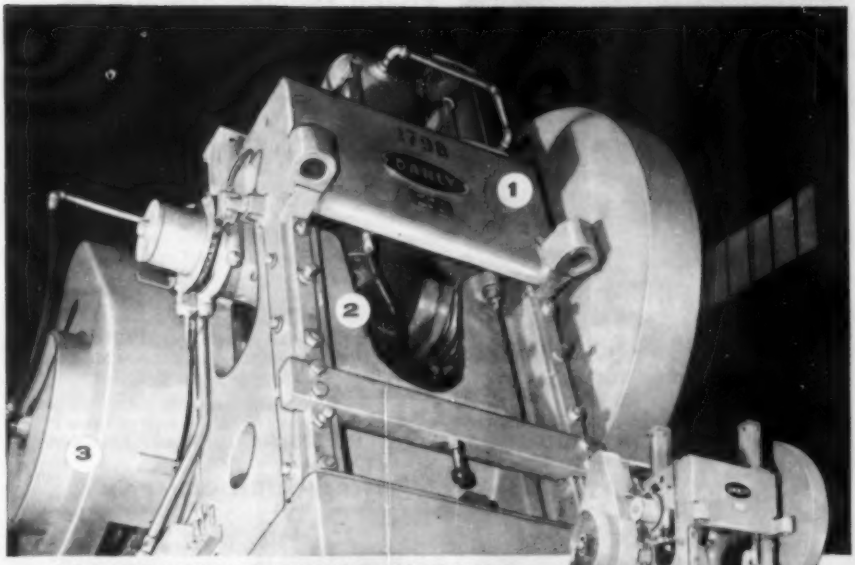
FROM ANY ANGLE



IT COSTS LESS TO RUN A DANLY O.B.I.

(1) **Compare a Danly welded-steel frame,** for example, with any comparable press available. A Danly frame is designed to the most rigid deflection standards, with extra brawn to resist shock and vibration. This means longer die life, less downtime for die maintenance, and more accurate stampings, too.

(2) **Compare the drive . . .** the forged and heat-treated crank shaft, the bronze-bushed bearings, the quiet gearing. Danly O.B.I.s are built to defy breakdowns . . . to give you bonus productive hours.

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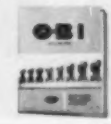
Compare a Danly O.B.I. from *any* angle. You'll find it's built for lower cost, more dependable operation. Write for the new Danly O.B.I. Catalog and the detailed specifications will convince you.



DANLY

DANLY

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The AP Parts Corporation (Toledo, Ohio), world's largest producer of replacement mufflers and tailpipes, uses 2 YODER Tube Mills to produce more than *300* ft. of 1¾", 1⅞" and 2" tubing per minute.

According to Mr. John Grindle, Plant Engineer, the two-man operated YODER Mills are vital to the production of the entire plant. "YODER Tube Mills earn their keep daily. They are easy to set up, maintain and operate . . . the welds are clean and uniform. We depend on them for constant quality, high production and minimum downtime".

The YODER Tube Mills at AP Parts exemplify the production economies and dependability of all YODER-built equipment, whether it be Pipe and Tube Mills, Cold Roll-Forming Machinery or Slitting Equipment.

If your products require ferrous or non-ferrous pipe or tubing, from ¼" to 26" diameters, there is a YODER Mill designed to produce it economically, accurately and efficiently.

THE YODER COMPANY

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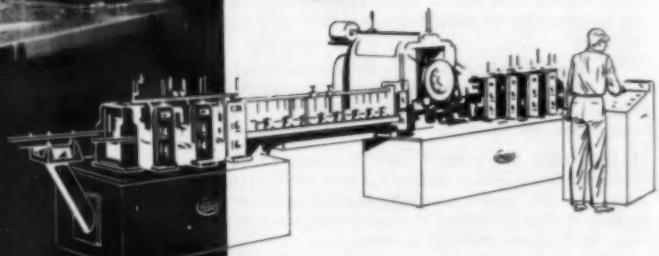
For complete information on YODER Pipe or Tube Mills . . . write for the fully illustrated, 88 page YODER Tube Mill Book . . . it is yours for the asking.



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PIPE AND TUBE MILLS (ferrous or non-ferrous)

COLD ROLL FORMING MACHINES

ROTARY SLITTING LINES

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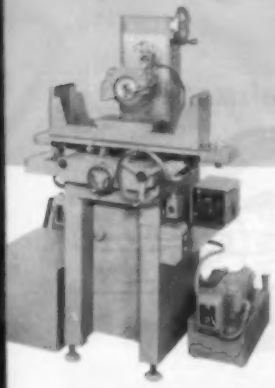
FOR BETTER PRODUCTIVITY...

NEW GRINDER FITS JOB and OPERATOR



ALL DH-612 SURFACE GRINDER
h hydraulic table drive (optional)

le travel: 7 in. x 13 in.
rk height: 0 in. to 12½ in.
dle lock for form and plunge grinding.
gnetic chucks, permanent and electric
s with SELECTRON® rectifier.

Here is the newest modern, low-cost DoALL surface grinder. It can double on either your tool room work or production runs.

This outstanding grinder offers you the practical combination of both manual and hydraulic worktable movement. It provides convenience and versatility you'll find in no other grinder. Saddle ways support the entire work area. There's no table climb. Operators can grind directly from handwheel calibrations to "tenth" accuracy—with vertical feed calibrated to .0001 in. and cross-feed to .0005 in. Relying upon this accuracy of controls, operators eliminate the old grind-and-measure practice.

The operator can quickly "fit" this grinder to himself. Machine height is adjustable. Table handwheel is easily moved from left to right side of saddle and its position adjusted radially for greatest convenience. These are a few operating features that increase operator productivity.

Complete line of attachments, such as "Cool Grinding"* coolant system, hydraulic table control and many others, can be purchased with machine or added in your plant. Before you buy any surface grinder, see the model DH-612. Ask your DoALL Sales-Service Store to demonstrate.

**Reg. T.M.—The DoALL Company*

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Machines and Blades · Surface Grinders · Power Saws
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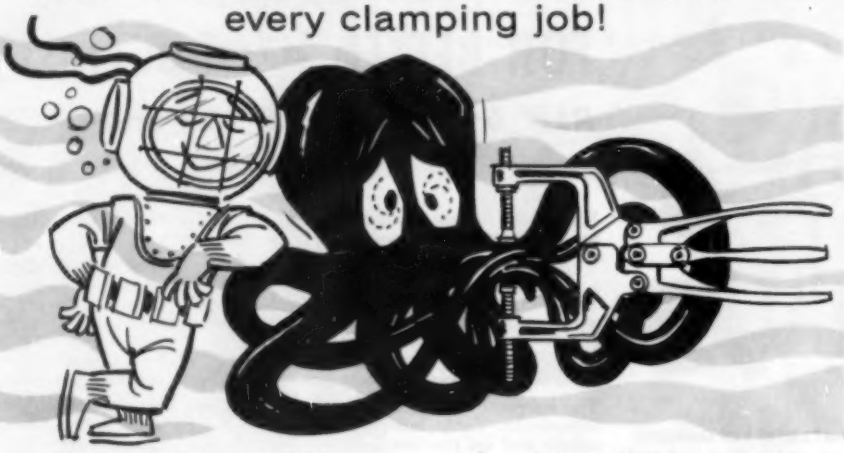

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made better three ways to give more positive holding, last longer!

1 Reamed holes
2 Hardened serrated bushings
3 High tensile strength rivets

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At Pipe Machinery, where prompt service is a basic precept, we maintain an extensive stock of standard thread plug and ring gages in a complete range of sizes through 1½". Minutes after we receive your order, your gages can be taken from a storeroom drawer, assembled, packaged, stamped and in the mail bag ready for shipment. For more complete information on the American Standard, NEF, Unified and pipe size gages we have available for immediate delivery, write us on your company letterhead today.

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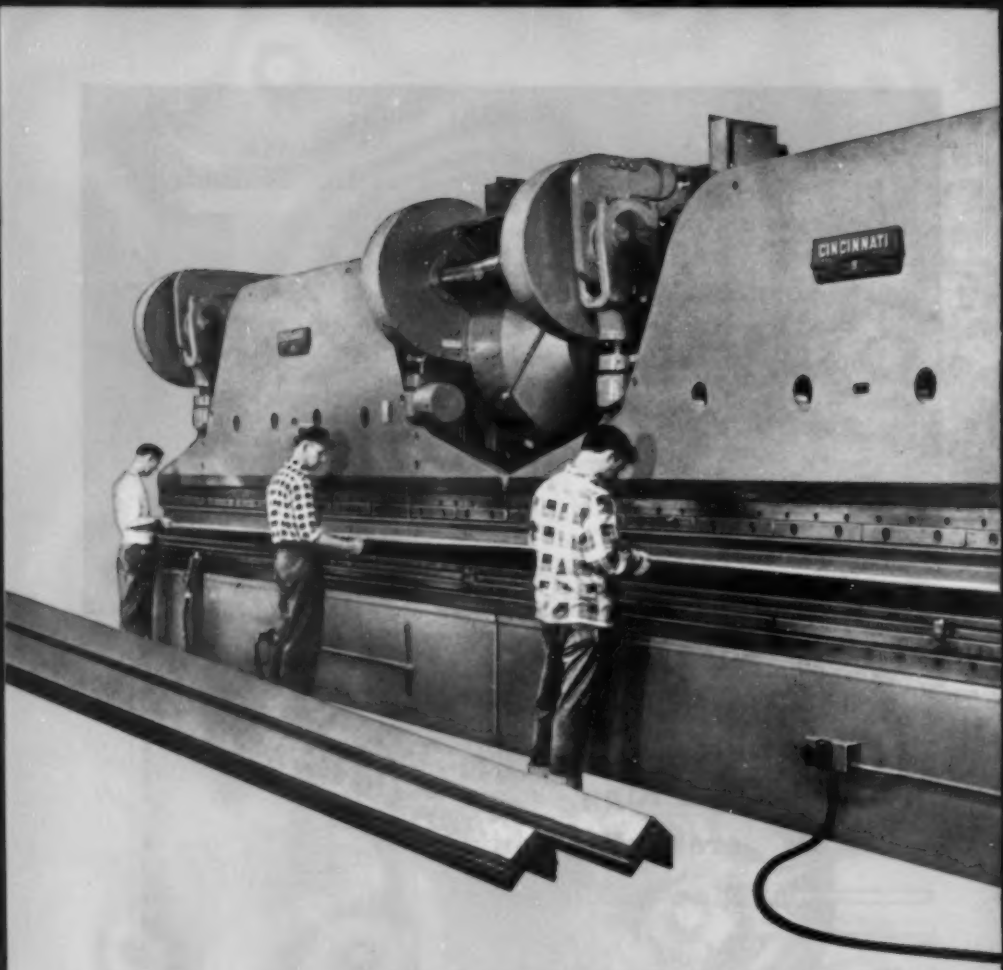
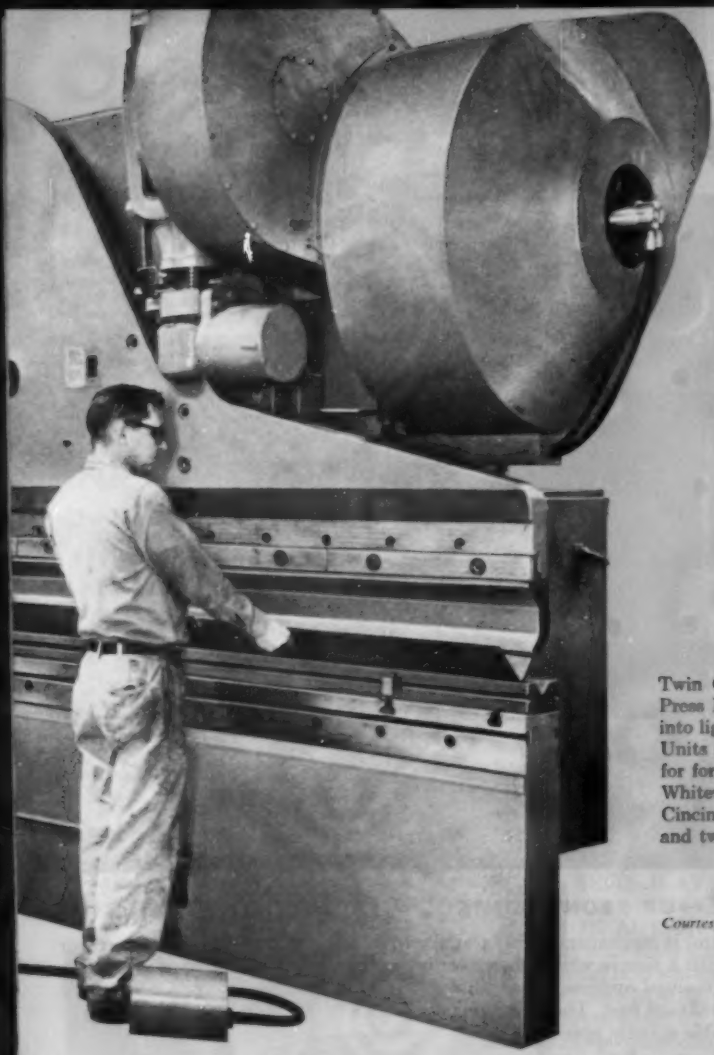


CINCINNATI® AUTOMATIC CYCLE PRESS BRAKE

improves

These twin Cincinnati Automatic Cycle Press Brakes have increased production "by 33% or more" and opened up lucrative new markets for the Whiteway Manufacturing Co., makers of outdoor lighting equipment.



Twin Cincinnati Automatic Cycle Press Brakes bend ¼-inch steel into light poles up to 40' long. Units can be operated individually for forming poles up to 20' long. Whiteway also has two more Cincinnati Press Brakes and two Cincinnati Shears.

Courtesy Whiteway Manufacturing Co., Cincinnati

production 33%

According to Whiteway President Joseph H. Spaulding, "Even an experienced operator, skilled at jogging the ram down on a conventional machine, can't match the speed of these Automatic Cycle Press Brakes. "I wouldn't consider buying another press brake without Automatic Cycle."

Buying these machines enables Whiteway to enter new markets in outdoor lighting which require poles up to 40 feet long.

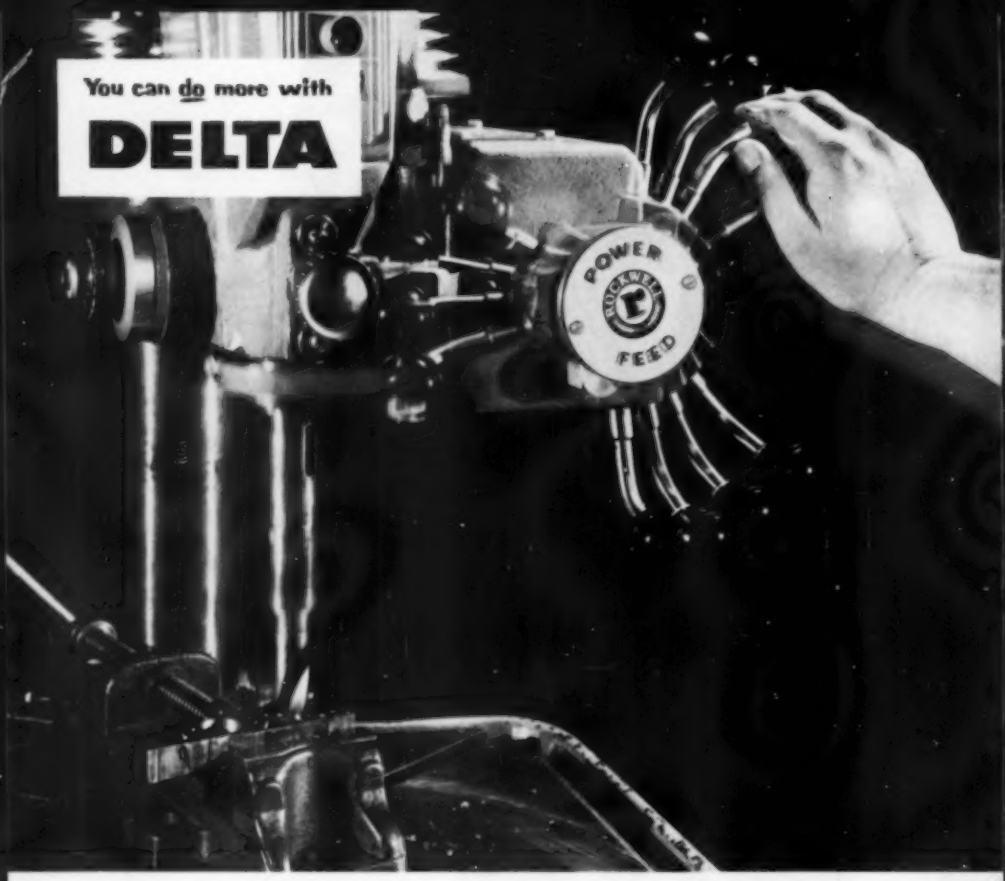
THE **CINCINNATI SHAPER** CO.

Shapers / Shears / Press Brakes Cincinnati 11, Ohio, U. S. A.

In Scotland: The Cincinnati Shaper Co., Ltd., Glasgow

You can do more with

DELTA



NEVER BEFORE—UP FRONT CONTROL WITH ONE HAND OPERATION

Unique pilot wheel control is mechanically integrated with the clutch control, allows operator to engage power feed with a simple wrist movement of one hand. Without any adjustments, operator can use rapid manual approach then power feed, skip drilling technique, straight power feed or straight manual feed. There are four feed ratios—.004, .006, .009 and .012 ipr—with each of five available spindle speeds.

NEVER BEFORE—SUCH A COMPLETE CHOICE OF MODELS

Floor model

Bench model

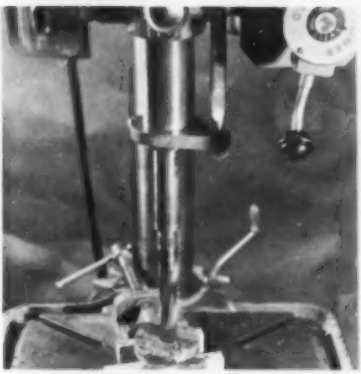
Overhead model

Multiple spindle model

ROCKWELL ANNOUNCES . . .

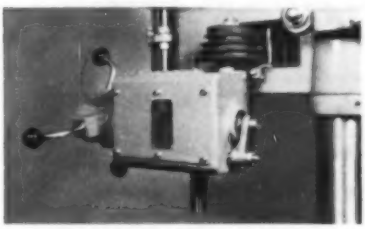
NEW *POWER FEED*

on famous DELTA 20" drill presses



NEVER BEFORE—"JOB TAILORED" DRILL POINT PRESSURE

A lathe-type cone clutch enables operator to adjust drill point pressure from 0 to maximum capacity of machine to permit power feeding on a production basis through a wide range of hole diameters. It furnishes power and thrust for drilling holes up to 1", yet delicately handles drills down to 1/16" diameter. Torque sensitive adjustability feature stops feed when overloaded—avoids drill breakage.



NEVER BEFORE—REMOTE CONTROL AND AUTOMATION

Actuating plunger, an extension of the clutch shaft, permits remote control which frees operator from manual effort. The power feed can be electrically, hydraulically, pneumatically, or mechanically interlocked with other machines or synchronized with devices such as rotary tables, clamps and work feeds for semi or full automatic operations.

Now Delta brings you advantages NEVER BEFORE AVAILABLE on a standard drill press—with the most advanced development in mechanical power feeds. Every model in the new Delta 20" drill press line offers power feed that gives you: *a front mounted pilot wheel for effortless one hand operation; infinitely adjustable drill point pressure; built-in feature that permits remote control or interlocking with automation devices.*

With the flexibility of feeds afforded by "flick of the wrist" control, operator's work is limited to loading, unloading, and actuating the tool. You get the adaptability of a power tool with the ruggedness, precision and capacity of a machine tool. Capable of handling production metalworking jobs done by machines costing much more, these new Delta power feed drill presses provide a simple, low cost method of increasing productivity and improving drilling quality.

Thoroughly tested through a rugged trial of 750,000 drilling cycles, Delta's new power feed line offers many other outstanding features and NEVER BEFORE AVAILABLE benefits that you cannot appreciate unless you see them demonstrated IN ACTION. Let your Delta Industrial Distributor show you how the 20" power feed drill press can help you cut costs (he's listed under "TOOLS" or "MACHINERY" in the Yellow Pages). Meanwhile, for FREE brochure giving details and specifications *plus* information on how to add New Power Feed to your present Delta 20" drill press, write: Rockwell Manufacturing Company, Delta Power Tool Division, 610G N. Lexington Avenue, Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

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Faster, Positive, More Accurate Inspection

Hole locations in templates and other flat work are read accurately at the rate of 1 to 3 holes per minute to ±.001" with the Wiedemann Inspector.

Both X and Y coordinates are read directly at the same setting with precision optical scanners. Work up to 36" x 42" is positioned *once* on the table against fixed locating strips. The exact location of each hole is read optically as soon as the stylus is positioned as shown above.

The Wiedemann Inspector eliminates all of the slow, costly steps required with ordinary inspection methods. Consistent accuracy is assured.

For full information about the Wiedemann Inspector, write today for Bulletin ***MT-7***

Wiedemann Inspector
For flat work
to 36" x 42" x ¼"

WIEDEMANN
MACHINE COMPANY
TURRET PUNCH PRESSES

DEPT. IA-10 • GULPH ROAD • KING OF PRUSSIA, PA.

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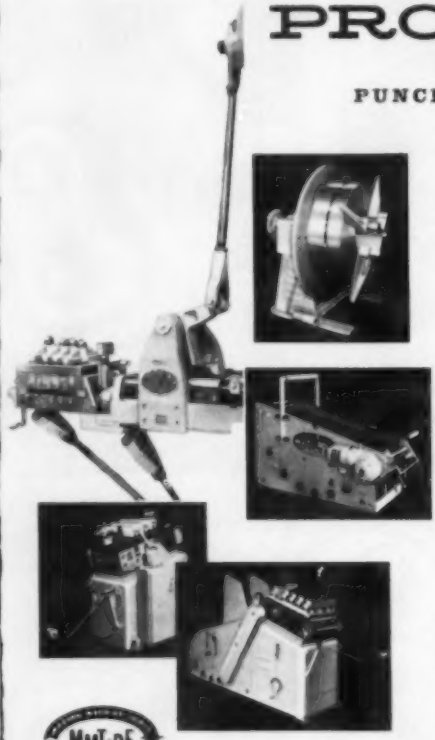
PROPOSAL

FOR PROFITABLE PUNCH PRESS PRODUCTION



When the familiar orange and black U. S. Tool Proposal reaches your desk you are on the road to Punch Press Production that will please the most pessimistic.

There is no "high pressure" in a U. S. Proposal. Each one details our method of handling the material for the particular metal stamping project involved. You get the facts . . . you get the figures.

To insure positive Punch Press feeding, major press manufacturers often specify U. S. Feeds and U. S. Stock Straighteners as original equipment. They do so because they know that **Profitable** Punch Press Production depends upon the utmost efficiency, from coil stock to finished stamping.

Consider your present equipment — is it really set-up for **Profitable** Punch Press Production? If not, let us submit our PROPOSAL to help you achieve greater efficiency and economy in your stamping operations.

Illustrated here are (reading from top to bottom): ACR-1642 U. S. Automatic Centralizing Reel; ACC-1648 U. S. Automatic Coil Cradle; SF-68A U. S. Slide Feed with Plain Straightener; PDS-16H U. S. Power Driven Straightener; PDSC-1648 U. S. Combination Cradle-Straightener.

MMT-PE

SEE US AT BOOTH 805

US PRODUCTS

U. S. TOOL COMPANY, INC.

AMPERE (East Orange) N. J.

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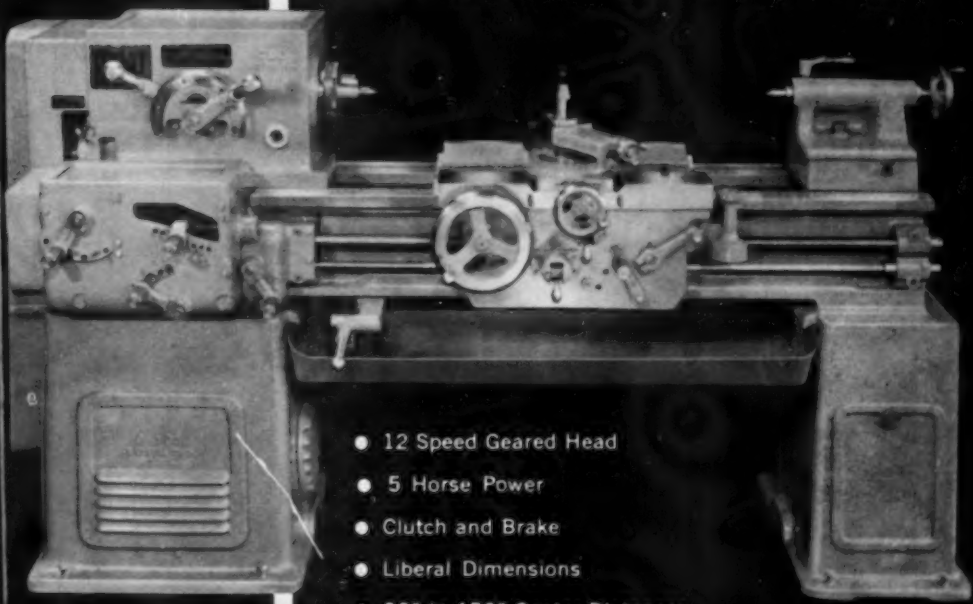
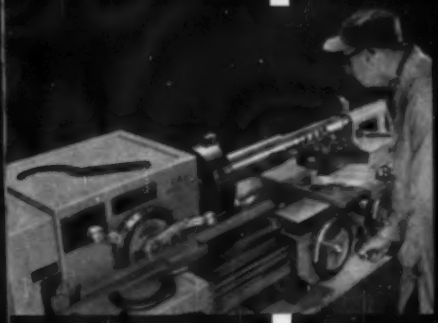
THE C&J 16" AND 18" MASTER MODEL GH LATHES



- 12 Speed Geared Head
- 5 Horse Power
- Clutch and Brake
- Liberal Dimensions
- 36" to 156" Center Distances



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BUILT-IN PRECISION

LONG LIFE

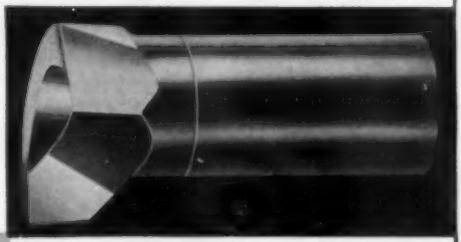
LOW INITIAL COST

16" x 6' — $3240

THE C&J CARROLL-JAMIESON MACHINE TOOL CO.

IN OUR 58th YEAR • BATAVIA, OHIO

Check CRITERION for boring tools



BORING TOOLS

Complete range of sizes.
Boring tools in both High Speed and Carbide to enter holes from 1/16" dia. to 2".
Criterion design permits 20% greater tool life.
Styles include tools for general boring or bottoming and facing.
Also available in extra long shank lengths.

THREADING TOOLS

Internal Threading Tools in both High Speed and Carbide to enter holes from 1/16" to 2" diameter.
True thread form remains for life of tool. Top face grinding, only, is required to resharpen.
Available in both standard and extra long shank lengths.

GROOVING TOOLS

Retaining Ring and "O" Ring Grooving Tools in High Speed only, available in all standard sizes.
These are ground to exact specifications as adopted by the National Aircraft Standards Committee, U.S. Army and Navy Ordnance and leading industrial concerns.

See these tools at your local dealer or write for literature.

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King

MACHINE TOOL ATTACHMENTS

...Cut Production Costs!

King /AK

Model 400 BED TURRET for Engine Lathes

Converts to ram-type turret lathe production. Self-indexing six station head mounted on 5" tilt for added tool clearance.

King / AK BAR FEED

King / PreCor HAND-LEVER COLLET CLOSER

Easy operating, ball bearing mounted

Collet capacity: 1-⅛" Fits variety of heads

For complete information [illegible] or these items, and factory [illegible] sheet metal tools, write:

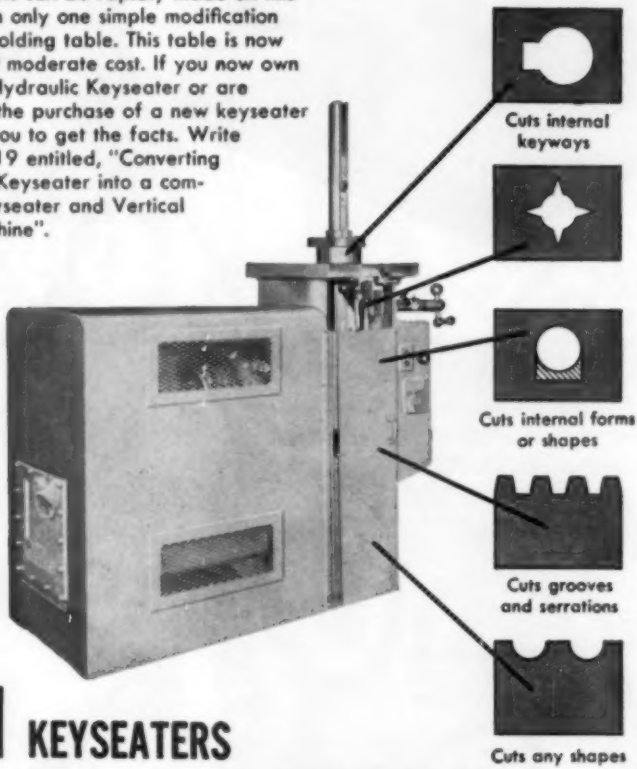
King MACHINE AND MANUFACTURING CO.

1171 East 32nd Street Los Angeles 11, California

TRIPLE THE USEFULNESS OF YOUR M&M KEYSEATER AND VERTICAL CUTTING MACHINE

Simple modification greatly increases productive capacity of this versatile machine.

An M & M Hydraulic Keyseater is not only a keyseater that cuts internal keyways up to 5" wide but a vertical cutting machine as well. Serrations, grooves, teeth—a wide variety of cuts can be rapidly made on this machine with only one simple modification — a work-holding table. This table is now available at moderate cost. If you now own an M & M Hydraulic Keyseater or are considering the purchase of a new keyseater it will pay you to get the facts. Write for Bulletin 19 entitled, "Converting the M & M Keyseater into a combination Keyseater and Vertical Cutting Machine".



M&M KEYSEATERS AND VERTICAL CUTTING MACHINES

98

MITTS & MERRILL • 1015 S. Water St. • **SAGINAW, MICHIGAN**

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T-J

LAUNCHES A NEW CUTTING TOOL LINE FOR MILLING ACCURACY

For precision milling to close tolerances, so vital in today's high-speed, high-production manufacturing, T-J now offers a new, improved line of milling cutters. The new cutter line features a high helix angle, double back-off, and a right-hand spiral to produce more and smoother cuts between grinds, and a free-cutting, stronger tool.

Specially designed and precision-manufactured for die sinking and production milling, the new line is designed to include flats on the shanks for set screw type drivers on all of the end and side milling cutters. Write today for complete information to the Tomkins-Johnson Company, Jackson, Mich.

Ask for completely new cutter catalogue No. 259.

T-J TOMKINS-JOHNSON

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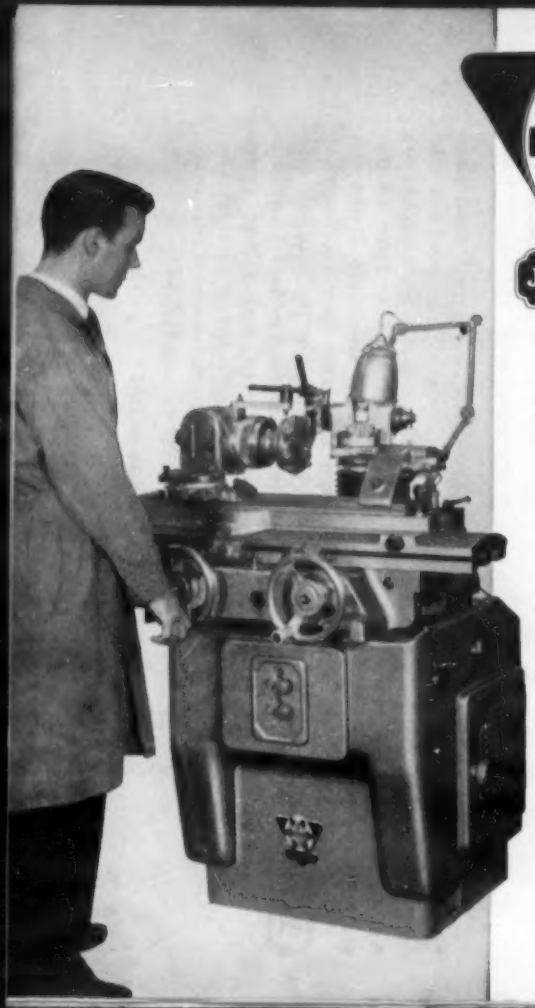

MICRO MATIC
MICRO CORPORATION DETROIT, MICHIGAN
MANUFACTURED BY
JONES-SHIPMAN
LEICESTER, ENGLAND

TOOLROOM GRINDERS

MANY UNUSUAL FEATURES ASSURE HIGH EFFICIENCY

MODEL 310
CUTTER AND TOOL GRINDER

This grinder efficiently performs a wide range of grinding operations. Thus, tools and cutters can be ground in shortest possible time to keep production costs at a minimum.

FEATURES:

Universal operating positions—all within comfortable reach of operator • Anti-friction cross saddle mounting assures sensitive control to cross feed • Table traverses on precision roller chains, giving "fingertip" control • Table dogs reversible—one end spring loaded and the other a dead stop • Table swivels a full 90 degrees in left-hand direction and 45 degrees right-hand • Large diameter wheel spindle, mounted on specially selected preloaded bearings • Universal Cutter Head adjustable to swing from 8" to 12" diameters • Cutter Head and Tailstock provided with clearance angle setting adjustments.

For additional information, write for Micromatic Bulletin 139W.

MODEL 1014
UNIVERSAL TOOLROOM GRINDER

This 1014 Universal Tool Room Grinder is designed to give extraordinary sensitive control that results in *high quality external and internal grinding.*

Wheelhead has deep throat capacity and wheel position is centralized in relation to table. This permits surface grinding and offers special facilities for broach grinding.

The extra Universal Cutterhead extends the versatility of this highly accurate machine to cover tool and cutter grinding.

FEATURES:

Hand cross feed and vertical feed in .0001" increments • Auto cross feed per reversal of table of .0001" to .007" over .025" (reduction in work diameter of .050") • Automatic table traverse, 4 speeds provided. Micrometer adjustment to table traverse in .001" divisions • Wheelhead saddle on anti-friction mountings • Precision built wheelhead motor on anti-vibration mountings • Wheel spindle unit swivels full 360° • Five external grinding wheel speeds • Grinding wheels fitted on either end of wheel spindle. Nitralloy spindle runs in plain bearings • Vernier scales to wheelhead and table swivels • Fast cross traverse to wheelhead for setting purposes.

For additional information, send for Micromatic Bulletin 206Q.

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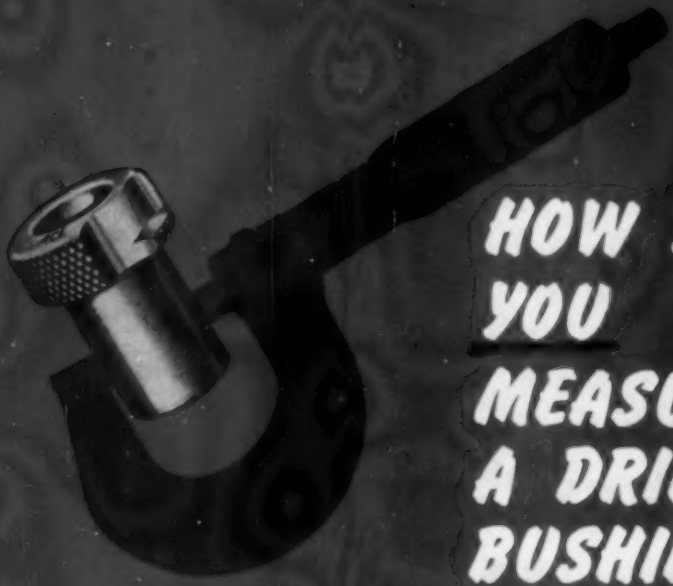
PRECISION PRODUCTION THROUGH MICROMATIC



HOW DO YOU MEASURE* A DRILL BUSHING?

The TOTAL MEASUREMENT OF AN ACE DRILL BUSHING is not done alone with gages, micrometers or light meters — such precise physical appraisal is essential but no more than the other characteristics that make up the true measurement of every ACE product. These include . . .*

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- **APPEARANCE** — reflects superb craftsmanship and better engineering design.
- **PRICE** — remember, "Twice the life means half the cost."
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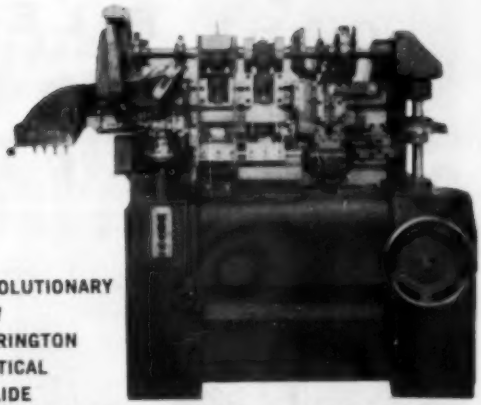
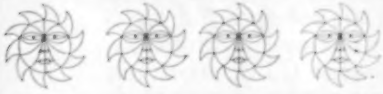


REVOLUTIONARY NEW TORRINGTON VERTICAL 4-SLIDE



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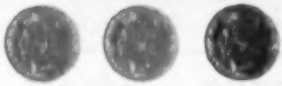
PRODUCING THIS PART

Close-tolerance enameling wiper die . . . having 26 critical dimensions . . . produced by General Electric Industrial Heating Dept.

AT FOUR TIMES THE SPEED

With one machine replacing five progressively tooled OBI presses . . . and producing the part in one-fourth the time.



AND ONE-THIRD THE COST

Saving $13,500 on a single production run of only three days duration!

This important new production tool, the Verti-Slide, offers sensational savings in direct and indirect labor costs, parts inventory, and floor space requirements . . . through elimination of secondary operations, drastic reduction in production man-hours, and lower tooling, down-time and materials handling costs. Write or call today for complete technical data . . . or a Torrington sales engineer.

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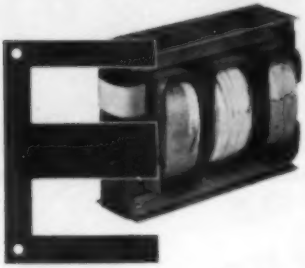
Cleveland Tool and Die

CASE FILE

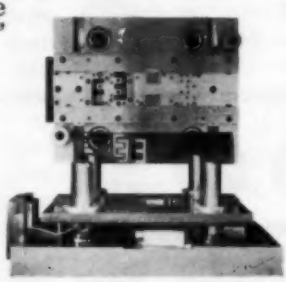
"12 to 15 TIMES LONGER DIE LIFE"

CTD PRECISION CARBIDE DIES SPEED OUTPUT OF "FRANCEFORMER" LAMINATIONS



Check the transformer on the next neon sign you see, and chances are it'll read "Franceformer"—trade mark of the France Mfg. Co. of Cleveland, O. This aggressive company supplies leading jobbers of neon signs throughout the country. For high-speed lamination production, France chooses CTD precision tungsten carbide dies. "CTD dies give us continuous production with far less downtime," says Emil Olds, plant manager. "We get 12 to 15 times the die life at only 3 times the previous cost."

ANOTHER EXAMPLE OF THE IMPORTANT PRODUCTION EFFICIENCY MADE POSSIBLE BY CTD PRECISION CRAFTSMANSHIP



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Dies, Jigs, Fixtures and Special Purpose Tooling

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Cleveland Tool and Die Co.

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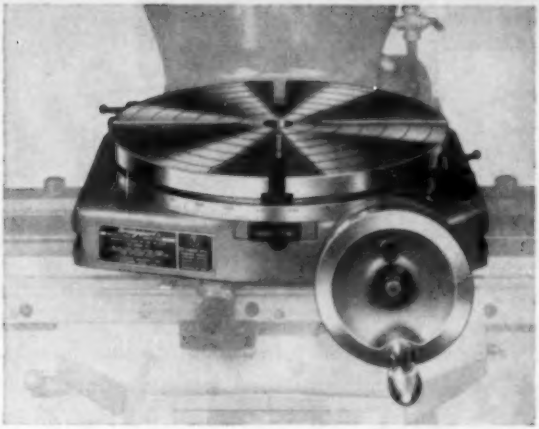
Bridgeport

Precision
ROTARY
MILLING
TABLES
MODELS 12", 15" DIAMETER



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"The Most for the Least"

WORM and SHAFT	One piece – Hardened and Ground – Alloy Steel.
GEAR	Normalized cast iron fastened to table and machined to extremely close tolerances. Worm can be disengaged to facilitate set up. Adjustment has been provided for the following: worm end play, table radial play, table thrust, backlash of worm.
GRADUATIONS	Table graduated every degree, dial every minute, adjustable zero mark, adjustable dial.
BEARING	Anti-friction, adjustable roller bearing for radial play, adjusting thrust washer for end play.
LUBRICATION	Worm and gear immersed in heavy oil, oil cups for center bearing, table base surface, etc. Unit completely sealed against foreign matter.
LOCKING	Two non-influencing locks are provided.
ACCESSORIES	Tail stocks, centers 90° angle plate, hold downs and handle clamps, indexing attachment and index plates.

Consult us or your nearest dealer for further details

Bridgeport MACHINES, INC.
Bridgeport, Connecticut
Manufacturers of High Speed Milling Attachments and Turret Milling Machines

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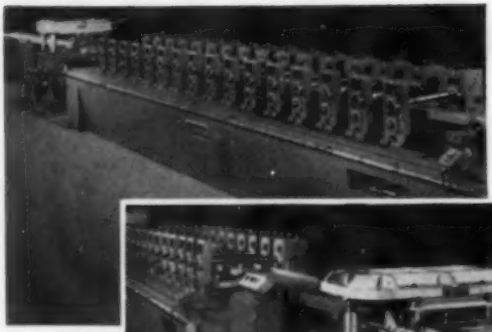

Roll Form Coil Stock

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BY THE MILE

Fully coordinated roll forming production lines, such as the above Ardcor installation, produce finished products on a miles-per-day basis.

Here an embossed, aluminum section of .019" stock is being formed by a leading aluminum manufacturer at a rate of 200 ft. per min. An Ardcor Prenotch Press, lower photo, and an Ardcor Cut-Off Press, upper left top photo, complement the high performance of the popular Ardcor 1-F Roll Forming Machine.

Ardcor can furnish complete roll forming lines for a wide variety of shapes and sizes—to customer specification.

Let us evaluate the greater production possibilities of your products. Write us.

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DESIGNERS, ENGINEERS AND BUILDERS: Single Roll Forming Machines or Completely Automated Production Lines for Cold Forming, Ferrous and Non-Ferrous Electric Weld and Lock Seam Tube Mills • Forming Rolls, Tubing and Pipe Rolls • Straightening, Pinch and Leveller Rolls • Cut-Off Machines • Slitters

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MAKES THIS THE EASIEST HANDLING HAND BLADE YOU EVER USED!

MILFORD's exclusive EASY-STARTING TEETH — fine milled teeth at the forward end of the blade — let you start the cut at any angle on the first stroke. If it must be sawed by hand — you'll do the job faster and easier with a MILFORD Blade! For *all* your hand hack sawing jobs, use the MILFORD Flexible REZISTOR teeth as sharp, fast-cutting and long-lasting as any all-hard blade. Back is tough and resilient . . . completely shatter-proof in normal use.

BUY FROM YOUR MILFORD DISTRIBUTOR . . . a local businessman, who stocks the tools and equipment you need. You'll SAVE TIME, CUT BUYING COSTS and REDUCE INVENTORIES.

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Saw Blade Specialists for Over 80 Years

NEW HAVEN 5, CONNECTICUT

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imagine

buying a **GRAY** planer for only

$30,660

above basic price includes 30" x 6' planer, one rail head, electric drive and controls

available with single or double-cutting heads ■ flush bottom bed

new Gray knee ■ synchro-mesh table replacer ■ full pendant control of table

Gray Safety nut ■ full floating drive shaft ■ quick acting saddle and slide clamps

abutment tool aprons ■ non-shock pneumatic tool lifters ■ infinite feed range

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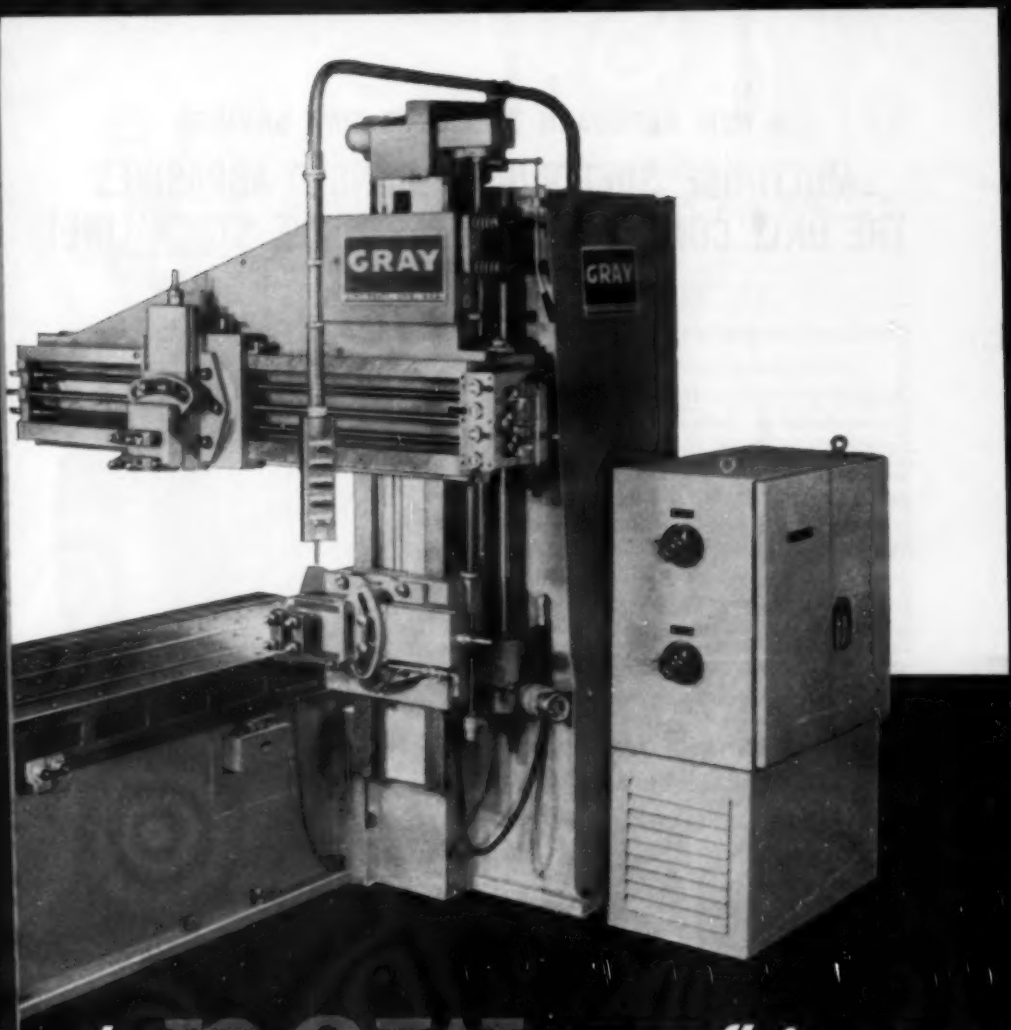

the new 30"-36"-42" flying scot

■ square locked throughout ■ knee and rail counterbalance ■ pyramid side walls on bed

■ vee ways ■ gray non-metallic ways—optional ■ maximum capacity—table width

■ 'reservoil' lubrication ■ high table speeds ■ duplex tables optional ■ new column

■ helicone transmission ■ space saver drive ■ table safety stop ■ forced lubrication

horizontal milling and boring machines
planers
planer type milling machines

THE G. A. GRAY CO.
CINCINNATI, OHIO

A NEW APPROACH TO BIGGER TIME SAVINGS

MULTI-USE, SOFT RUBBER BONDED ABRASIVES THE ONLY COMPLETE, COMPREHENSIVE STOCK LINE!

Brightboy's unique, time-saving abrasive-and-rubber action achieves exceptional precision results, improved product quality. Simultaneously BURRS, CLEANS, FINISHES, POLISHES. Bridges the gap between the grind and buff, frequently in one operation. Works all metals, wood, glass, laminated materials, some plastics.

Readily available Silicon Carbide and Aluminum Oxide grains—grades extra fine to extra coarse—in soft, semi-firm, firm and tough rubber binders. 49 numbers JOB-MATCHED to conventional and automation production methods.

NEW BRIGHTBOY CATALOG . . .

gives new and revised wheel sizes, center hole specifications conforming to American Standards safety specifications, machine speeds, grains and textures. No plant should be without this valuable reference catalog describing this revolutionary new concept of abrasive applications. WRITE FOR IT!

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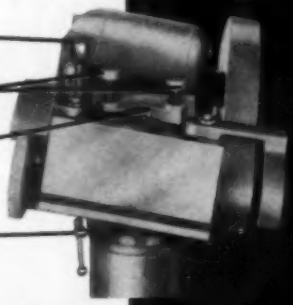

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BOOK REVIEW

Cemented Carbides by Dr. Paul Schwarzkopf and Dr. Richard Kieffer (The Macmillan Co., 60 Fifth Ave., New York 11, N.Y., 349 pages, $15). The field of cemented carbides, whether you produce them or use them, has been so confused that there has long been a need for the complete story to be told in one book. **Cemented Carbides** is that book.

That the subject is handled, and handled well, by authorities in their field is evident throughout the book. From the first chapter which reviews the historical development of cemented carbides through to the last chapter which covers metal cutting with carbides, the material is well prepared and exceptionally well presented to the reader. The style of writing is most enjoyable for such a difficult technical subject.

The first chapter's coverage of the historical development of cemented carbides is more than a recanting of dates and deeds. It serves as a technical foundation for the following chapters which discuss how carbides are produced. These chapters are more than an explanation, for the authors have included endless directions which are an aid to the reader.

The middle chapters of the book describe the mechanical and chemical properties of all the cemented carbides in commercial production and also those which are being produced in experimental quantities. Of special note is a chapter which includes the new oxide and boride cutting materials.

Outstanding, because of the extensive coverage given the subject is a chapter

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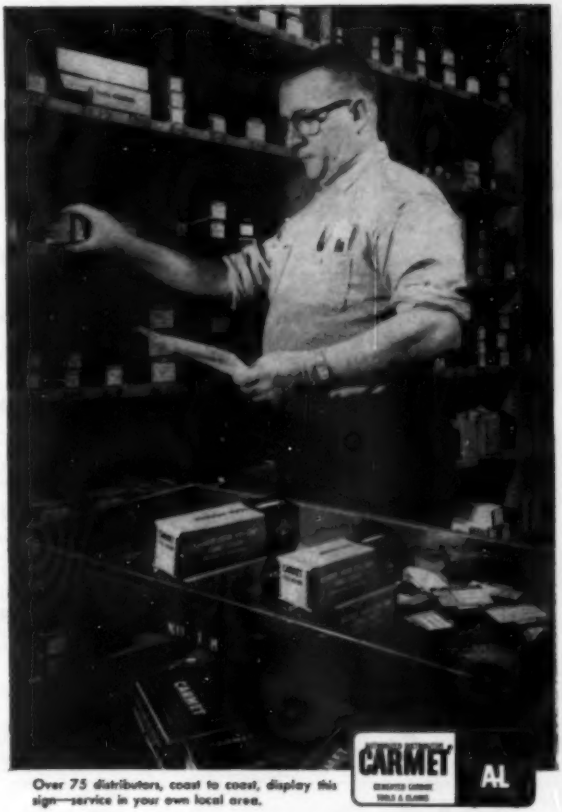

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features in this issue

HACKSAW BLADES—PROPER SELECTION AND USE CAN SAVE YOU THOUSANDS—First of a series about saw blades, one of man's oldest cutting tools. In this part about Hand Hacksaw Blades, Engineering Editor Darrell Ward traces their historical development and analyzes the selection of the proper blade for a job and how the blade might best be used. .....**Page 109**

THE SECRET OF HOW TO KEEP FROM SLOWLY GOING BROKE lies in Industrial Economics, says Harry Conn in his article on ENGINEERING and TOOLING. Described as "The Science Of Spending And Making Money", Industrial Economics is very much a part of our lives. .....**Page 87**

TOOL SIGNATURE—BASIS FOR INTELLIGENT APPLICATION—This month Horace Frommelt discusses the role of the other tool geometries and how they can be used to advantage for turning and boring operations. As he explains, "Tool geometry is both inherent in a tool and part of its setting." .....**Page 91**

PROGRAM FOR APPRENTICE DIE MAKERS is concluded in this issue as Paul Prikos outlines the fourth year in this most interesting program for training apprentices. .....**Page 99**

WHAT STEPS MUST BE TAKEN TO AVOID DISTORTION IN SHEET METAL PARTS? When there is a need to avoid distortion in sheet metal parts having many dimples, holes, embossed areas, and bends, it is not so much the type of tool needed as the sequence in which they are used that counts, says Allan Young in his article on PROCESS ENGINEERING. The example used is an aluminum chassis for an electronic receiver ....**Page 101**

PUT THEM ON WHEELS!—A firm in Portland, Oregon found that production was increased and costs cut by putting wheels under shears, brakes and presses. The wheels enabled them to change production lines quickly to suit different jobs. .....**Page 125**

STANDARD MACHINE HEADS AND TRACER CONTROL SHOW TREND IN TRANSFERS—A report on an unusual transfer machine developed to produce receiver parts for the NATO rifle by the George Gorton Machine Co. Engineering Editor Darrell Ward describes the thinking which produced a unique machine with a minimum of design and building costs. .....**Page 130**

on cemented carbides as wear-resistant materials. The authors include wire drawing dies and mining applications in addition to wear-resistant parts in this chapter.

Metal cutting with cemented carbides includes an effective summary of the principles of machining. Detailed attention has been given to the determination of tool life, with emphasis placed on the role of tool life of carbide cutting tools.

Mathematics For Industry by S. E. Rusinoff (American Technical Society, 848 East 58th St., Chicago 37, Ill., 565 pages). This is a revised edition of an earlier work by Mr. Rusinoff, whose goal continues to be the presentation in simplified form of the mathematics most often needed in the field of engineering and machine shop practice.

All of us are prone to forget the mechanics of mathematics when there is little practice to refresh our memories. Rusinoff's book on mathematics serves well, not only as a continual refresher but as a thought stimulator. Good indexing speeds the search for specific problems.

In addition to a review of arithmetic, algebra, geometry, and trigonometry, the author has chosen to include chapters on Screw Threads and Gears; Logarithms and the Slide Rule. Other chapters cover engineering computations, the use of graphs in the solution of engineering problems, computation of automatic controls for automation, and problems of inspection and quality control.

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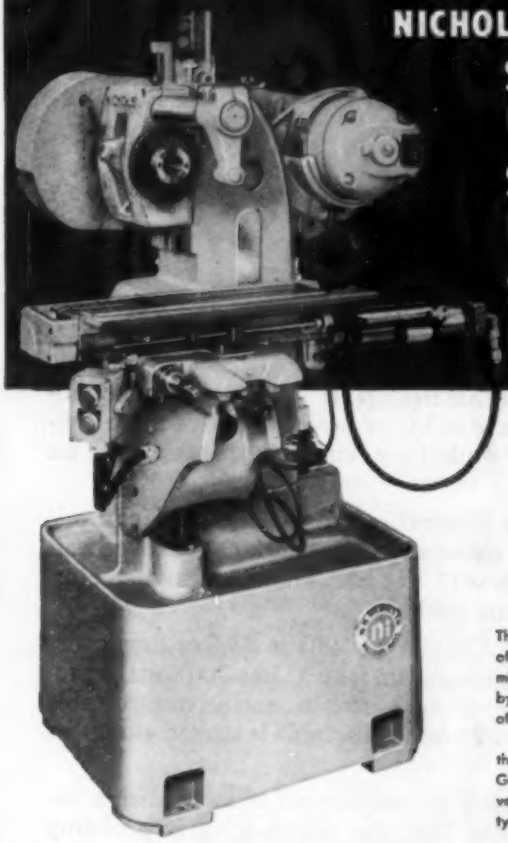

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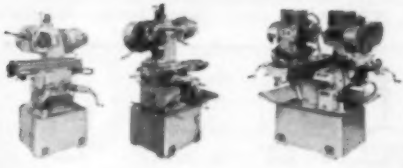

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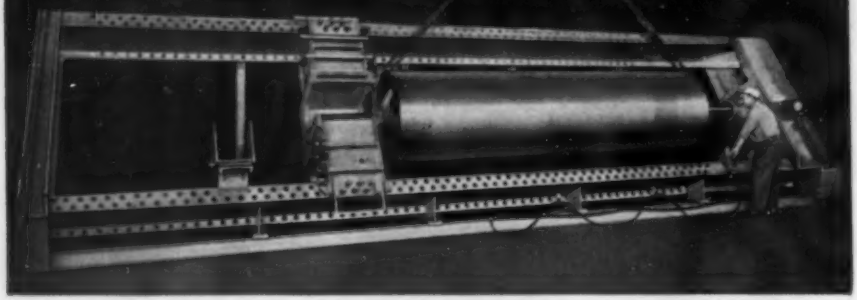

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By **Bill Schleicher**
Vice President and Editorial Director
Hitchcock Publishing Company

Only Some N.C. Equipment Suitable For Machine Tools

Labor Transferred From Line To Office

■ One of the things frequently forgotten when discussing numerically controlled machines is the fact that the machine is still the heart of the operation. Some N. C. equipment manufacturers are not impressed with the difference between numerically controlled office equipment and numerically controlled metal removing machine tools.

The subject is brought to mind by a remark made by an engineer of a Detroit plant. Said this engineer, "Without a man to operate the machine we should get much better accuracy and higher production; furthermore, we won't have need for fancy machines because N. C. will do it all." Now, this was obviously not a production man speaking, who would scarcely embrace such a pale view. In this entire matter of N. C., it appears that the gap between engineering and production is widening. In too many cases, to have, or not to have, N. C. has become a pure engineering exercise and not a problem of metal removing. This is unfortunate.

Numerical control can locate the drill and activate the spindle, but from then on you'd better have an efficient

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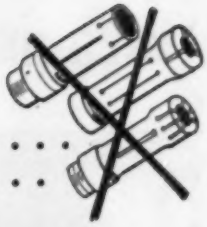

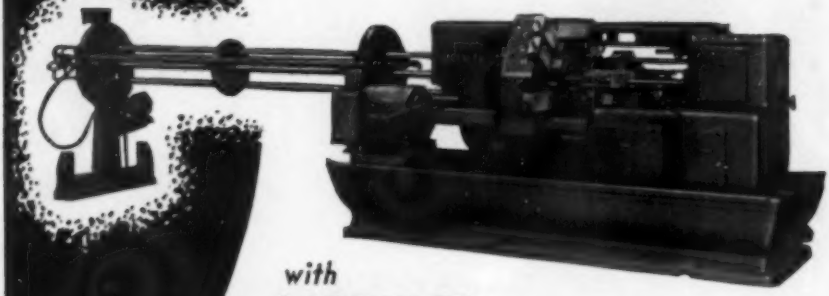

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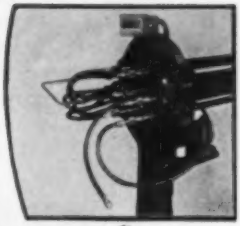

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drilling machine and a sharp drill. N. C. will not guarantee a straight hole, nor the finish, nor dulling of the drill, nor that the casting will not have hard spots. N. C., as such, cannot guarantee accuracy.

As long as machines are composed of mechanical, electrical and hydraulic movements, as long as machines must have rigidity and stability, require spindles, bearings, headstocks, chucks, ways and gears, there will be possibilities of inaccuracies that no N. C. equipment in this world will correct. The machine, with its cutting tool, is still the master of the job.

The metal is removed at the point of the tool. N. C. assures the tool being in the right place at the right time, it assures proper speed, feed and depth of cut, controls the movement of the tool and tells it when to begin removing metal; at this precise point, it pays to have a good machine. The attitude of some control manufacturers that the machine is secondary is nonsense.

There is still much about N. C. that is open to discussion and to improvement. With over 100 different systems to choose from, and any number of contributing components, the eventual selection of a system can be made from a combination of several thousand. Certain of these systems lend themselves for use in metal removing operations, some are ideal for office equipment, others can be used to balance the treasurer's checkbook. One point stands out: the type of system is important and not any kind of N. C. equipment can be used with metal removing machines.

Before any N. C. champions climb on our backs and pummel us, and ask why we hate them, we hasten to add that we are firm believers in progress and the future of numerically controlled equipment. We're delighted it's been developed, it represents a forward step for metalworking. We're all for it. However, let reason prevail. Where N. C. is applicable, it's terrific; where it's not, it'll cost you plenty. Don't overlook such standard and unglamorous things as tracer controls which, when properly used, will do a mighty fine job for pennies. In many shops N. C. equipment is a must. It will save money and increase production, and even though it's on the expensive side you can't afford to be without it. Grit your teeth and put your money on the line. But, be absolutely sure a modern machine tool, vastly improved in the last five years, and possibly provided with tracers, cannot do the job as well at a much lower initial cost.

On the subject of saving man-hours and reducing labor time, are we perhaps chasing will-o'-the-wisps? What we are really doing is transferring labor from the line to the office. Are we increasing non-productive labor much faster than we are reducing productive labor time? It is a situation to watch.

Certainly, the entire world of manufacturing is changing. We're a long, long haul away from the overhead belt days. This is all for the good. Splendid things are ahead for manufacturing, and numerically controlled machine tools are merely one vital phase of the revolution. However, as in all revolutions, remember to keep your heads. • • •

DI-ACRO ROD PARTER cuts off 3,250 pieces/hr. for Geometric Stamping Co.

Donald Boyd, methods engineer, shows parted stock and the formed part handle for material handling equipment

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By **Harry Conn**
Chief Engineer
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ENGINEERING and TOOLING

INDUSTRIAL ECONOMICS, secret of

How To Keep From Slowly Going Broke!

■ In March of 1947 there were approximately 700 manufacturing firms going bankrupt per month; in 1959, the number had risen to approximately 1,100. I would venture that the main cause was a real lack of knowledge and application of industrial economics.

Industrial economics certainly embraces much more than the calculating and selection of machine tool replacements. In fact, machine tool replacement economics is but a small, though important portion of industrial economics.

Industrial economics has been defined many ways, but the best definition I like is, "It is the science of spending and making money".

There are several good economic replacement formulae and plans available today, each different, but having their own peculiar strong points and advantages. One of these requires three costly books to be able to complete the necessary forms. The plan seems to be beamed at production machinery; is hopeless for tool room acquisitions.

The main purpose of this article is to arouse interest in this subject and create a real knowledge and application of the subject. This can be accomplished, perhaps,

Considering a $13,000 machine tool? Do you think of it as costing $13,000 or as 16¢ more cost per hour?

by showing an important and simplified application of industrial economics to the buying of a new machine. This is not necessarily referring to the replacement of a present obsolete machine tool.

As an example, consider the cost of a $13,000 lathe for a progressive tool company that realizes machine tool designs and methods are improved considerably in a period of seven years. Assume that the Commission of Internal Revenue's schedule of depreciation allows you to depreciate the equipment in seven years and it can be resold for $4,000.

Depreciation of a machine can be computed by several methods. So as not to be judged liberal, let's use the straight line method which is least favorable to the taxpayer (or purchaser). The straight line method for depreciation is the most widely favored because of its simplicity and adaptability. The straight line method assumes that the decrease in value during the life term is directly proportional to the time elapsed.

If the $13,000 machine can be disposed of for $4,000 this will then leave a net expenditure of $9,000. This expenditure of $9,000 is going to be written off through depreciation over the seven years of useful life as an allowable deduction for tax purposes. The result will be in a reduction of taxes paid, regardless of tax rate.

If a firm makes over $25,000 a year, their income will be taxed at a rate of 52%. (The owner of a firm that isn't in this bracket would be wiser to work for some one else.) By having an allowable deduction of $9,000, the amount of depreciation to be taken on this machine through tax savings would be $4,680 (52% of $9,000). This tax savings of $4,680 plus the disposal value of $4,000 leaves a balance of only $4,320. The $4,320 represents the total cost to the purchaser of this machine tool. Then divide $4,320 by seven years for $617 average cost per year to own the equipment.

If the purchaser operates his plant 2 shifts per day for 50 weeks (80 hours X 50 weeks), the machine will run 4,000 hours per year. Then divide 4,000 hours per year into $617 per year cost and *you can have a new machine for 16 cents per hour* (exclusive of floor space charge, wages, power and maintenance). If the machine is used only one shift then the cost to the user is 32 cents per hour.

When the economics of purchasing a new piece of equipment is understood in this manner, it is ridiculous for a firm not to buy new equipment if the two main assumptions are correct. The two main

assumptions are, you must have work for the machine and be in the 52% tax bracket. The chances are that if you are diligent, concerned, or interested enough to read this article your firm is already in this bracket. A productive piece of equipment is a good investment, not just an expense.

The author does not pretend to give the reader a comprehensive understanding of the economics of machine tool purchases; he hopes to whet your appetite for the subject. Nevertheless, the article is factual and correct. The proper time to start using "Industrial Economics" is day before tomorrow. The next article will deal with the economics of cutting tools, jigs, fixtures, holders, etc. for which analysis are not available.

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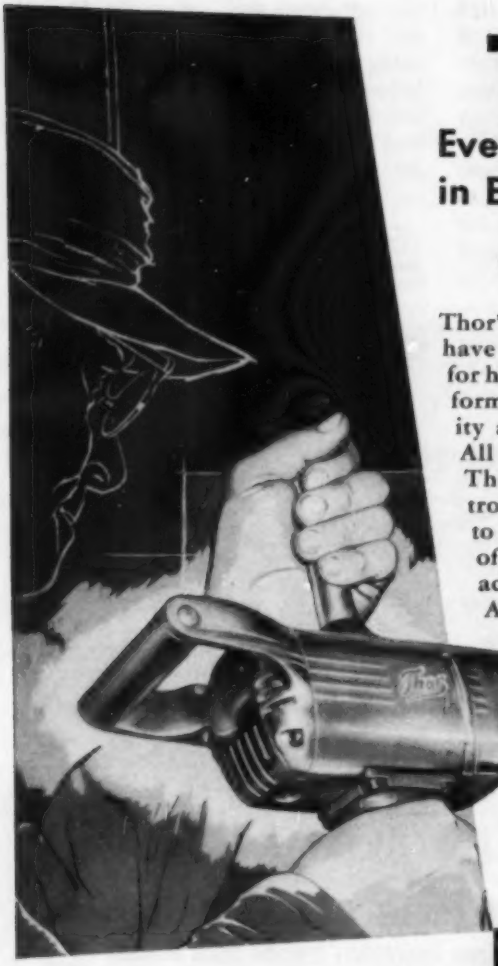

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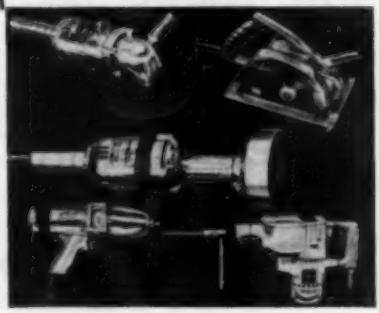

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By **Horace Frommelt**

CUTTING TOOLS

Tool Signature—Basis For Intelligent Application

■ Since Taylor's work on metal removal, which culminated in his famous ASME presentation in 1906, every cutting tool has been clothed with such importance that it is now customary to speak of "tool signature." The cutting and relief angles, when properly specified, constitute this so-called "signature."

This angle specification plays such an important part in the success or failure of a machining operation that its fundamentals cannot be overly emphasized. In a previous discussion, the lead angle—variously referred to as the "approach angle," the "corner angle" and the "entering angle"—has been sufficiently detailed to permit only a brief review before proceeding to the numerous other angles which a good operating tool must present to a workpiece to achieve what one slogan so aptly expresses: "Profits are made at the point of the tool."

Referring to Figure 1, the lead or entering angle is clearly set forth. This all-important angle can help to reduce the pressures on the cutting edge by reducing the chip thickness, by lengthening it and thus spreading the

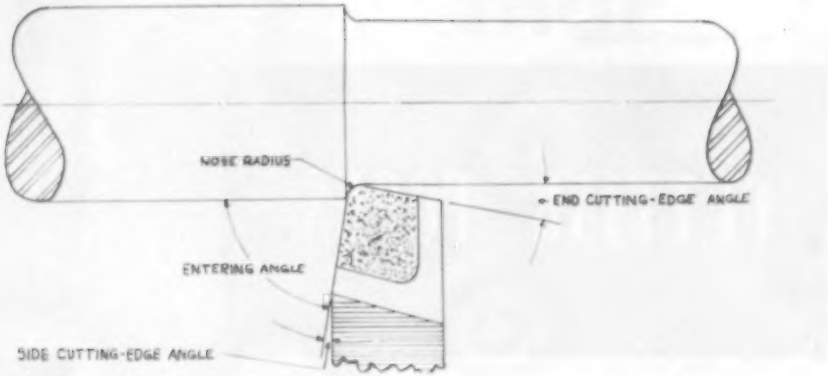

Figure 1. Entering and End cutting-edge angles. Importance of the lead angle is brought out on repetitive cuts on short versus long work pieces. (Drawing from Baker and Kozacka)

cutting forces over more cutting edge and, finally, by presenting the tool to the workpiece gradually rather than by a broadside attack.

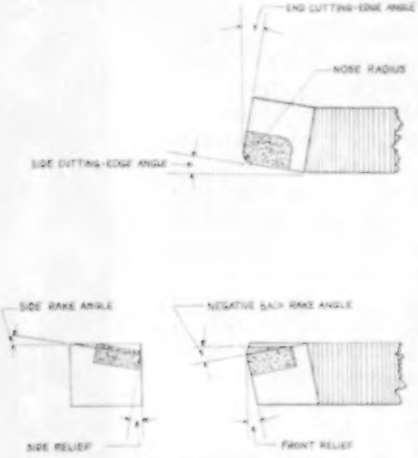

Figure 2. Important angles of a single-point tool are shown here. But, changing the tool's position in the tool holder can change these angles. (Baker and Kozacka)

It is worth another brief remark to emphasize this entering angle because of the advent of ceramics. Without such a gradual penetration of the cutting edge into the hard ferrous materials, the use of ceramics would be seriously limited, if not eliminated.

So, too, are the other tool signatures important. Figure 2 pictorially presents the important angles. That is, the angles that are part of the tool geometry itself. But there is a further angle development depending on the positioning of the tool. An attempt has been made to show this pictorially in Figure 3. Here we are looking at a turning job not from the operator's position but from the tailstock, towards the head. Note that the back rake angle is larger when the tool is set below the center line of the workpiece as shown to the left as compared with the angle at the right when the tool is set dead on center. This represents an increase in the

positive angle over and above that ground into the tool and which is a part of its own geometry. Since this change in cutting angles takes place when the tool is raised or lowered with respect to the center line it is seldom resorted to when specifying a cutting angle. The difficulties inherent in measuring the effective angle practically assure that the cutting angle specified is to be ground into the tool rather than have it affected by its positioning.

There are times however when positioning is not always a matter of choice, but a necessity. It must be clearly understood that setting a tool *below* center (of the workpiece) in OD turning *increases* the positive back rake. The exact opposite is true however when boring. This is indicated in Figure 4. Here the tool is set above center with an increase in the top or back rake of that angle. If originally these angles are positive this will be increased. If negative, then the negative is counteracted. If the original negative back rake of the tool were 7° and the setting of the tool below center (in OD turning) were changed in angle by 5°, then the resultant angle is 2° negative. If boring is under consideration, then the original negative back rake of the tool of 7° is changed to 2° negative if the tool is set above center sufficient to change the cutting angle by 5°.

Cutting angles are, therefore, not merely a matter of tool geometry but also of tool setting. Fortunately it is seldom that we need to give serious consideration to setting a tool other than on center. When it is necessary to raise or lower it with respect to the center line of axis of the cylinder being turned then it must be further noted that below center for OD turn-

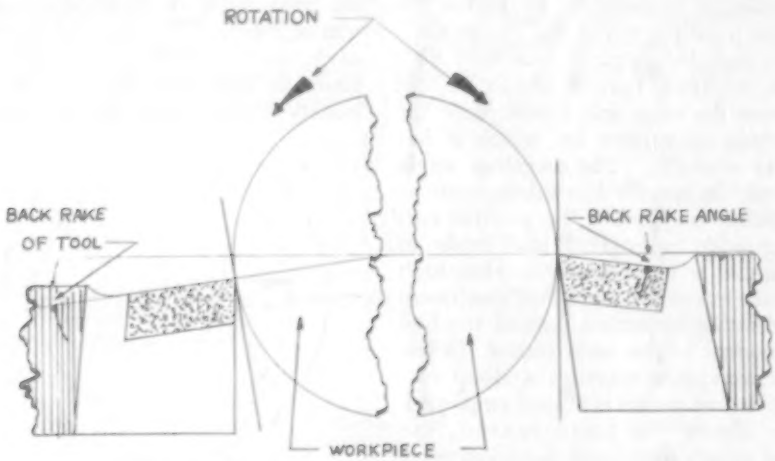

Figure 3. Positioning of the tool changes the tool's geometry. In this view, towards the chuck, the back rake angle is larger when the tool is set below the center line of the workpiece. (Baker and Kozacka)

ing effects a positive angle while in boring above center creates this positive angle.

Returning to Figure 2, two very important cutting angles in a single point tool are the side and back rake angles. In this illustration the negative signature is shown. In Figure 3 the difference between the positive and negative becomes immediately apparent. Looking at the right hand side of the Figure 3 illustration the positive angle tool geometry is presented. In Figure 5 the same general set-up is repeated but with a negative back rake angle. In this latter illustration the basic reason for the negative geometry is set forth graphically. Note that the included angle "B" at the cutting edge is greater than 90°. The cutting forces are directed against this cutting edge in such a fashion as to place the carbide in compression for which it has magnificent ability to withstand destruction. In Figure 3—right hand portion of the illustration—the included angle is less than 90°; the cutting forces shear or cut across the edge and hence place the carbide in tension for which it has little strength. The negative angle should be specified as infrequently as possible—only when the positive cutting edge specification tends to crumble or break down as when high tensile materials are being machined.

Another important part of the tool geometry is the nose radius. Unless the workpiece specifies a sharp corner, a nose radius is always employed. For almost the same reason, the lead or entrance angle is seldom zero, except when the shoulder on a turned piece is to be measured at 90°. Not only is the life of a tool increased with a nose radius but the finish is better with each ten thousandth increase in the radius. With a sharp point ground into the cutting tool at the nose the tendency is to turn "threads" or a "barber pole" into the surface of the component.

With a nose radius, a line of cutting edge is presented to the workpiece rather than a point. As the radius increases this line increases; hence there results a skiving or scraping effect giving rise to a far superior finish. In the end, the nose radius is generally specified with tool life in mind though today the matter of surface finish is also important.

Relief or clearance angles are the final portion of a tool signature. There must be clearance worked into the tool front and side edges to prevent rubbing, heeling or interference. The essentials of these angles are shown in Figure 2. The side and front reliefs are presented in the illustration at bottom of Figure 2. The end cutting edge angle and the end relief angles are generally the same. Hence it is customary to refer only to the end cutting

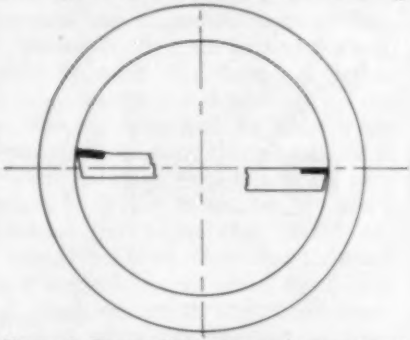

Figure 4. There will be times when you want the tool to be off center. In this case a boring tool may be set above center to increase the effective back rake angle.

edge angle. Note that if a nose radius is not employed there is little justification for referring to an "end" cutting edge angle. The point—as long as it is in existence—will do the cutting with little or none of the end portion of the tool being effective for cutting.

To summarize: Tool geometry is both inherent in a tool and part of its setting. This is true of all turning, facing and boring operations with single point tools. Setting a tool below center when OD turning effects a positive angle which must be united or tied into the angle ground into the tool. When boring, the opposite is true so far as setting with respect to the centerline is concerned. Above center in boring effects a positive angle. Note, if the original tool angle is negative the addition of the positive angle due to setting reduces the original tool negative and may even convert it into a positive. This is actually being done today with positive angles ground into blanks that are held or clamped onto a negative well or recess in the shank.

Back and side rake angles are important cutting angles. They may be negative or positive. The negative should be sparingly used and only to protect such cutting edges as are relatively fragile when specified of ceramic or carbide when applied to extremely high tensile material.

Finally the nose radius is an essential part of this "signature" of the tool. A point at the nose is never used unless the workpiece is specified with a sharp corner at a shoulder. The nose radius increases the life of the tool and at the same time betters the surface finish appreciably. Generally it is specified in thirty seconds—one, one and one-half and sometimes 1/16". Of course the nose radius may be larger, considerably larger, depending on the characteristics of the workpiece and its specifications. A radius may be specified at a shoulder and this then determines the nose radius. Generally, however, this dimension is held down to 3/64" at the most. To increase it beyond this point increases the cutting pressures at the nose and may even counterbalance the usually good effect of a reasonable radius at this critical point of the tool. • • •

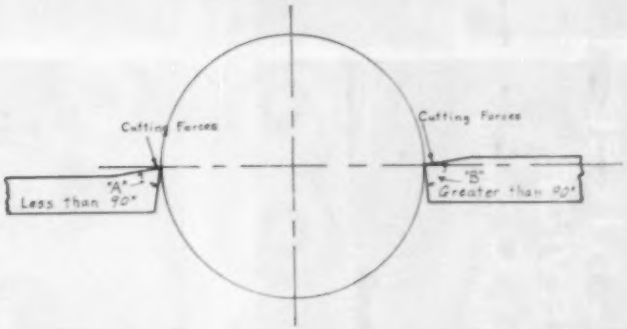

Figure 5. In a setup similar to Figure 3 differences in negative and positive rake angles can be easily seen. Principal reason for selecting negative rake angles is to take advantage of carbide's hardness and compressive strength, and the economy of indexable throwaway inserts.

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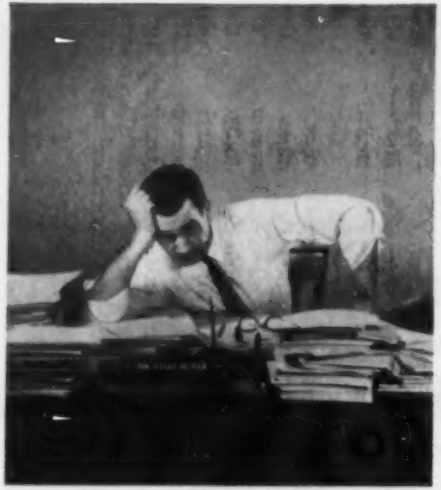

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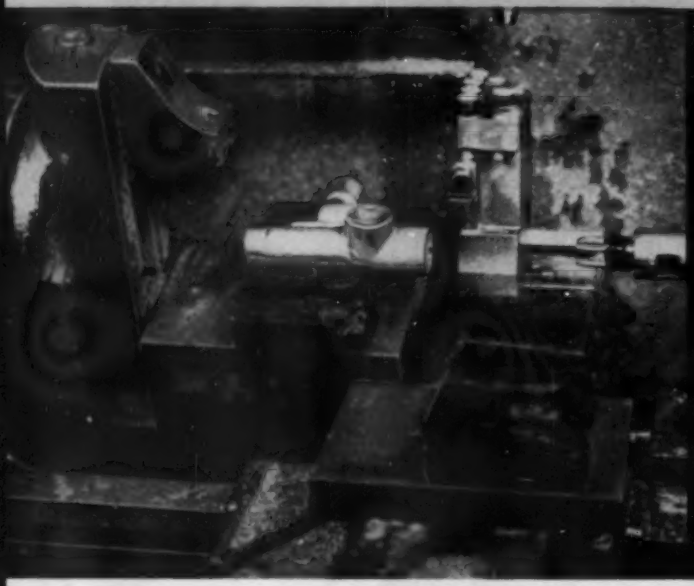

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THE PRACTICAL DIEMAKER

An Effective Outline For Teaching Apprentice Die Makers

Part 3

■ Our outline covering the fourth year of training has fewer subjects to cover but each topic is extensive and needs detailed explanation while instructing the apprentice. The outline helps the apprentice assimilate the vast amount of knowledge expected of him in the early formative years and it will help to suggest outside reading. Those shops having a varied amount of technical magazines should allow old copies to be available to the apprentice for his reading away from the shop. This will help broaden the scope of interest of the up and coming new tool and die maker.

The fourth year outline is as follows:

FOURTH YEAR OF APPRENTICESHIP

1. Introduction to the theory of drawing metals.
   a. Metal reaction in a draw and a few simple remedial approaches.
   b. Simple draw dies—description and component parts. Action of metal drawn from a flat blank to a drawn shell.
   c. Explanation of various pressure methods: spring; rubber bumps; hydraulics.

2. Plain draw dies.
   a. Tool steels used, hardness, lubricants used for various metals.
3. Theory of draw die reductions.
   a. Common and extreme percentages.
   b. Computation and problems.
4. Draw Die's Continued.
   a. Component parts.
   b. Variations–blank, draw and pierce; pinch trim; draw and deboss.
5. Theory of Redraw die operations.
   a. Redraw over post; push thru; double redraw; and inside out (reverse draw) dies.
6. Rectangular draw dies.
   a. Rectangular blank and draw.
   b. Blank development of rectangular dies.
   c. Pinch trim and combinations of pierce and pinch trim of rectangular parts.
7. Miscellaneous draw operations.
   a. Sizing; ironing; tape; and impact.
8. Curling Dies.
   a. Inside, outside and wiring curl.
9. Progressive draw dies–simple type.
   a. Methods of freeing blank–hourglass (cut out section); slit; or double blank.
10. Introduction to various lamination parts and dies.
    a. H.C.H.C. and carbide material.
    b. Electrical discharge method for intricate shapes.
11. Study of tooling and dies with micro switch stops, light beams, solenoid and/or cylinder circuits.
12. Advance study of gage fixtures.
    a. Optical gaging; trunnion fixtures.
    b. Micro inch finishes and symbolic meanings.
    c. Air and electronic gages.
    d. Comparator and microscopic usages and layouts.
13. Intricate progressive dies.
    a. Complete sectioning, grinding, sinking, etc.
    b. Inherent problems of piece parts and potential troubles in the die itself.
14. Tool and Die estimating.
    a. Various methods of estimating.
    b. Cost of die set, steels, heat treating, screws and dowels, etc.
    c. Realization of die costs and the importance of avoiding costly errors and their relation to diemaking performance.

With this conclusion of the series on apprenticeship training, I wish to state again that proper training is ever so important. The responsibility of producing the best possible mechanics should be our industry's constant goal. Every day we read of the need for educational improvement and the need to move swiftly from some of our archaic pedagogic methods. Without reservations, if the tool and die apprentice in any shop prepares himself according to the outline as given in our series, he will be qualified to work at his trade any place. And for those who may question the ability of apprentices to grasp all this, or even a goodly portion of the outline material, I know from years of observation that apprentices enrolled in the Chicago Tool and Die Institute night school are doing it every year.

• • •

By **Allan Young**
Process Engineer
Collins Radio Co.

6

PROCESS ENGINEERING

CREATIVE ENGINEERING

What Steps Must Be Taken To Avoid Distortion In Sheet Metal Parts?

PROBLEM— Need to avoid distortion in sheet metal parts having many dimples, holes, embossed areas, and bends.

SOLUTION— It's not so much the type of tools needed; it's the sequence in which they are used that counts.

■ In processing a sheet metal part with many dimples, holes, embossed areas, and bends, such as the aluminum chassis shown in Figures No. 1 and No. 2, the Process Engineer is confronted with many problems. The most serious of these is distortion. The necessary tooling to produce a part of this type is usually rather uncomplicated but the sequence of operations needed to avoid distortion is sometimes difficult to determine except through trial and error.

The part shown in Figures No. 1 and No. 2 is produced by a series of cutting and forming operations, each of which affects the others. Figure No. 3 illustrates what is done in the piercing and blanking operation. At the end of this operation the flat part will look like this draw-

Even simple parts require clear process thinking

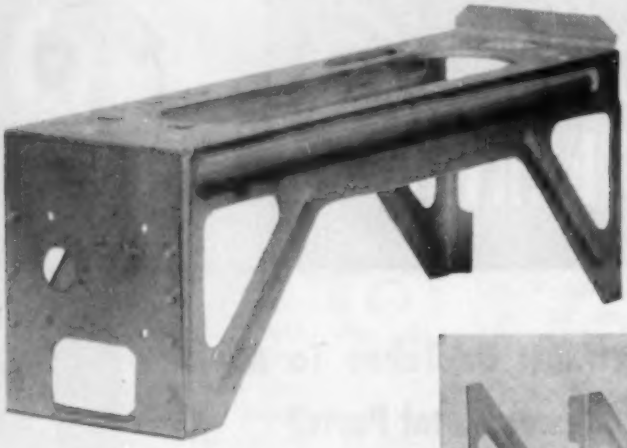

Figure 1.

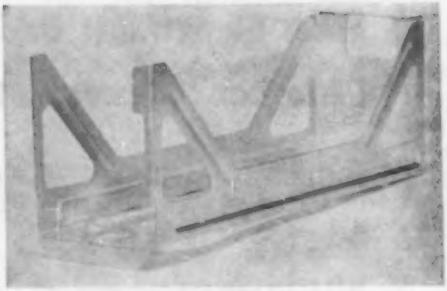

Figure 2.

ing. Due to the method of dimensioning hole locations, the majority of the holes must be produced in the part after it is completely formed to its final shape.

Next, the part is embossed in 6 places as shown in Figure No. 4. The embossing is done prior to dimpling because of the tendency of small formed areas to be distorted if put in first. The large formed areas would then distort the dimples. Also, the dimples are dimensioned with tighter tolerances than the embossed areas. The embossed areas are stiffeners only, as a general rule, while the dimples are clearances for screw heads and won't stand much distortion.

Figure No. 5 illustrates the dimpled areas in the chassis. Note that distortion is allowed in certain areas where two dimples are close together or where it is known that an opening (which is there for clearance of another item in the assembly) will distort larger, therefore having no adverse effect on the part.

The large extruded cutout shown in Figure No. 6 was put in as the last operation before forming up the sides because it was known that this opening, either before or after forming, would be more subject to distortion than any other area of the part. This operation, too, tends to distort the rectangular shaped opening, but this is allowable. It does not, however,

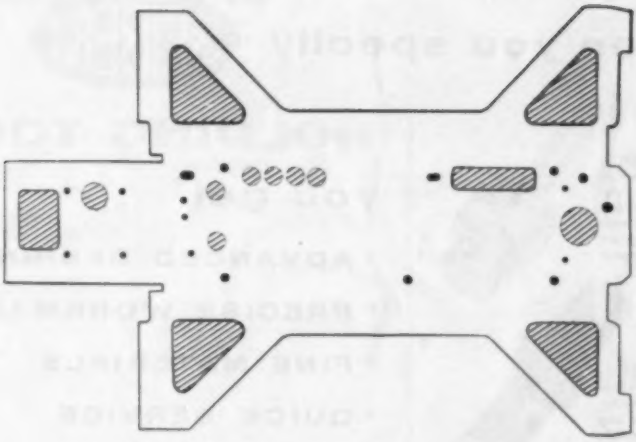

Figure 3. The piercing and blanking operation.

cause distortion of the dimples and embossed areas, nor any of the holes. If this opening were put in prior to dimpling and embossing, these operations would distort it very badly.

Many other tools, such as special form dies with clearances for dimples and embosses, and drill jigs for use on the final formed part are necessary to produce this chassis. However, at

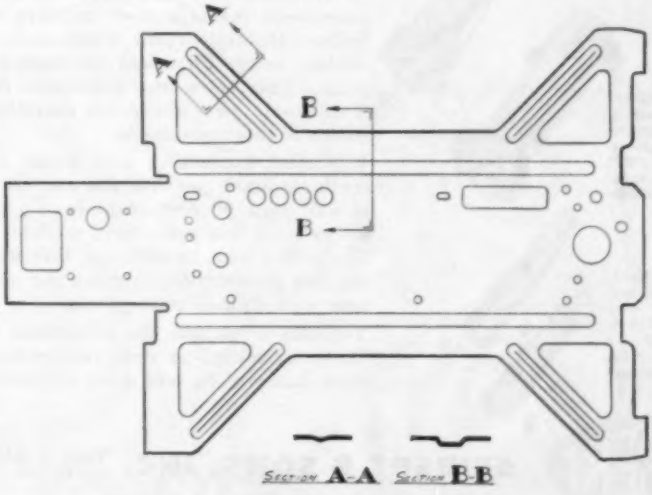

Figure 4. Embossing is done in 6 places.

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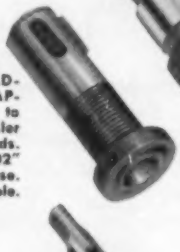

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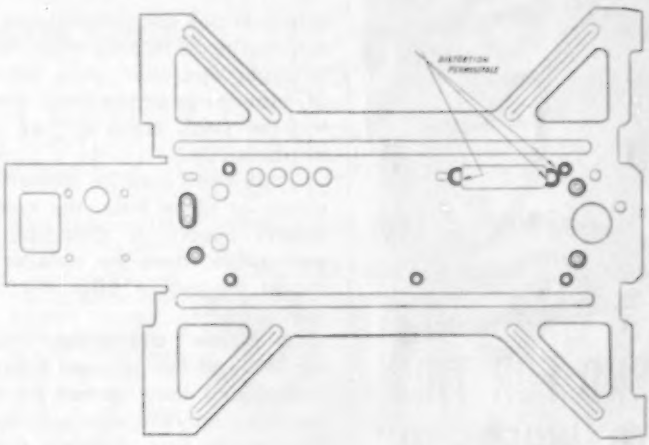

Figure 5. The dimpled areas in the chassis.

the time these operations are performed, the distortion problems have been solved.

Generally speaking, a good set of rules to follow are these—

1. In the case of embossing, dimpling, or forming, put in the larger areas first. The smaller operation

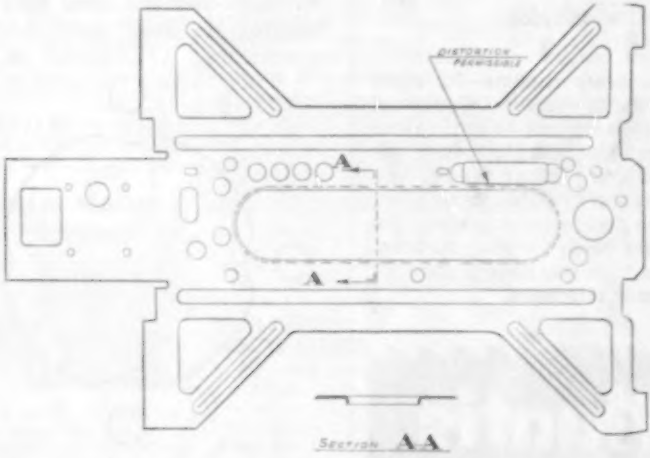

Figure 6. Large extruded area put in as the last operation before forming up the sides.

does not pull enough material to distort the large formed area, but since a larger operation pulls quite a lot of material in proportion, it will distort the small areas if they are put in previously.

2. If metal must be formed near a cutout or large hole, the cutout will always distort. If distortion is not permissible, then the hole or cutout should be put in after the forming operation.

3. Where distortion due to proximity of two pierced holes is expected and they cannot be pierced simultaneously the smaller hole should be pierced first. Piercing the large hole will have little or no effect on the small one, but if the small holes are pierced after the large one, a bulging condition such as that illustrated in Figure No. 7 will occur.

To repeat, it is not so much the type of tools needed, but in what sequence they are used that avoids distortion in sheet metal parts.

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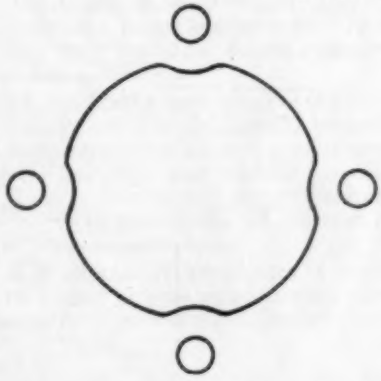


Figure 7. This is a distorted pierced hole which could have been avoided by piercing the small holes first.

Precision Ground **Atrax** SOLID CARBIDE TOOLS AND BURS

Job Applications

New cutting efficiency has been designed and engineered into a new line of Atrax Stub Routers. These are solid carbide standard, off-the-shelf tools available in nine sizes from 1/16" to ½" diameter and 1" to 1½" in length.

Precision ground, the Series 1546 Router has a single, straight flute, straight shank and right hand cut. Tolerances are kept to +.000 −.003.

SHOP TESTS PROVE SUPERIORITY

Photo A shows the second of two high speed steel routers failing to cut copper clad Fiberglas printed circuit board. Note the burning of tool and material and the jagged hole at left in test work piece.

The new Atrax Router plunged and cut at 20,000 rpm leaving clean slot shown in photo B.

COMPARISON OF TEST TOOLS

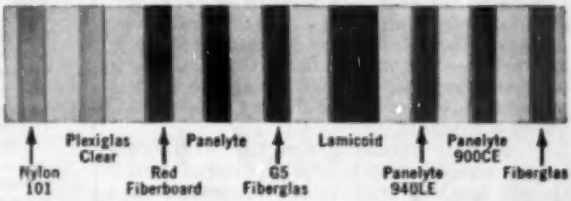
Two high speed routers on left were unserviceable after a few seconds. Atrax Solid Carbide Router showed no wear land and left clean slot with no bur on either side of printed circuit board.

NEW ATRAX STUB ROUTER PLUNGES, SLOTS, FORMS EXTREMELY HARD-TO-CUT MATERIALS

ADDITIONAL TESTS ON OTHER TOUGH MATERIALS

Nine other materials commonly used in printed circuit board work were tested. All were cut quickly and efficiently with the new Atrax Router.

These materials can also be drilled readily with the new Atrax Micro-Drills available in wire sizes from #1 to #80.



SOLID CARBIDE TOOLING RESULTS

Many new, extremely tough materials can be worked faster, easier with Atrax Routers, Drills and End Mills. The Atrax Company can furnish information on speeds and feeds for best results.

Send for 148 Page "Standard Reference" on Solid Carbide Tools... THE ATRAX COMPANY

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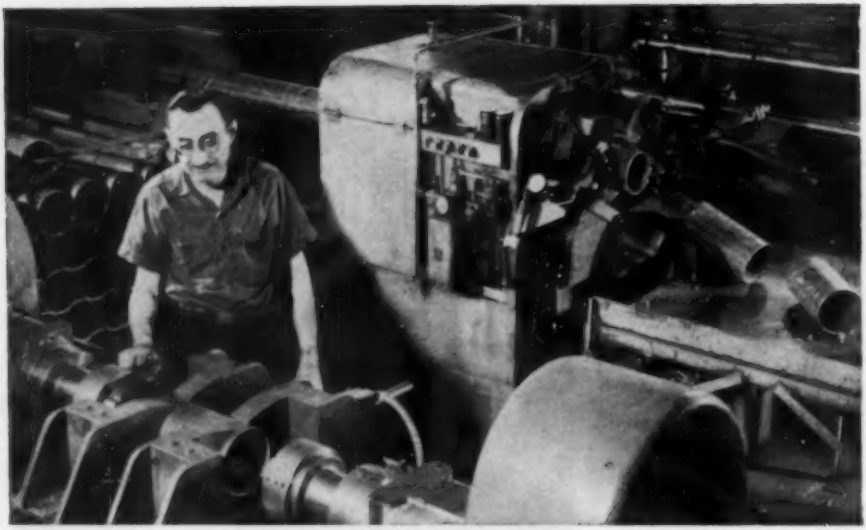

Tubing for this job must meet the most rigid specs

This manufacturer of heavy-duty idler rollers has turned to increased automation and tighter material specs to improve production. Note automatic feed and cut-off of tubing in background . . . the quick setup for double-end counter-boring at the next station.

Tubing for this job must meet highest standards for uniformity of size, straightness and close tolerance of concentricity. But where do you find large O.D. tubing to meet these rigid specs? At Ryerson, of course—home of the industry's tightest quality controls.

Here you choose from the nation's largest stocks. And you're assured of consistent quality that is so important to meet the demands of automation.

So when you next need tubing or help with selection and application problems, be "Metalogical"—call Ryerson.

THE TYPE OF TUBING YOU NEED IS HERE

Carbon Steel Tubing—seamless and welded, round and square, cold drawn and hot finished.
Alloy Steel Tubing—seamless rounds.
Fluid Power Tubing—Rockrite cylinder finish, seamless and welded; hydraulic fluid line; seamless and welded cylinder tubing.
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Ledloy® 170 Tubing—fast machining, 170 sfm.
Stainless Pipe and Tubing—cold drawn seamless and welded. Also welded ornamental.
Aluminum Pipe and Tubing—all commonly used alloys and tempers.
PVC Pipe and Tubing—time-tested Ryertex®-Omicron PVC.

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Part 1—Hacksaw Blades

HACKSAW BLADES . . .

Proper Selection And Use Can Save You Thousands

First of a series of articles about the problems of sawing

By **Darrell Ward,**
Engineering Editor

■ There is no such thing as an all-purpose hack saw blade and the man who thinks so is throwing money down the drain in your shop. The difference in length of two popular sizes of blades could conceivably make a difference of $20 a week or over $1,000 a year in labor savings alone!

Hand hack saw blades are commonly supplied in two popular lengths and there are two common sets of teeth. There are four different pitches of teeth—the number of teeth per inch. And, there are six different types of blades for cutting different materials.

It doesn't take long to visualize about a hundred possible combinations in blades, each different from the other. Now, multiply that by the number of different people you have using hack saw blades, and that by the number of different kinds and shapes of material you cut, and that by the number of different holding devices for the work. This will give you some idea of the infinite variety of conditions into which you can run.

No matter how experienced the mechanic, a good job requires the correct blade.

Problems Come From Teeth

Practically every problem in hack sawing can be related directly or indirectly to the teeth. If you had only one choice of material for saw blades, the pitch and set of the teeth would be the major consideration. It is conceivable that over 90% of all work could be performed with only one *type* of blade—if you could have your full choice of teeth. The teeth on a saw blade are as important for cutting metals as the teeth in your mouth for chewing a wide variety of foods.

If simple teeth were formed on the flat edge of a simple blade, the tool wouldn't cut very far. Like other cutting tools, the saw blade must have some relief. This is provided by "setting" the teeth to produce a kerf slightly wider than the thickness of the blade.

Teeth Are Set Differently

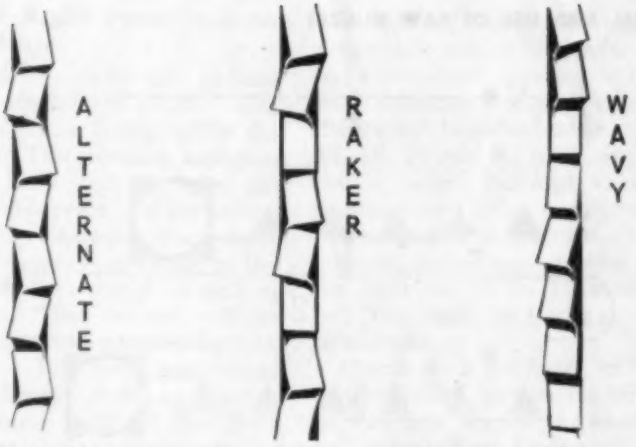
There are different ways to set the teeth. *Alternate Set* teeth are set with one tooth bent to the right, the next to the left. This is common for wood cutting blades.

By adding one straight tooth between pairs of right-and-left set teeth, the *Raker Set* is made for better chip clearance. This set is used mostly for coarse blades and for precision cutting band saw blades.

The most common blade for hand hack saws employs *Wavy Set* teeth. These are formed by alternately bending two or more teeth to the right and the left in graduated degrees. A center line drawn through the center of each tooth would trace a snaked smooth curve. This set is popular in fine tooth blades, especially those designed for cutting thin metal and hard steel. An important factor in manufacturing a good quality wavy set blade is even balance. The waves must be formed uniformly and equally on both sides or the blade will not cut in a straight line. One of the

DO YOU USE AN ALL-PURPOSE BLADE?

You probably are aware of a number of different kinds of hack saw blades, but may still make use of one or two "all-purpose" blades in your shop. If you really want an education on blades, make this test. Perform some typical operations with what you have. Then, after reading this article, utilize as many of the pointers as you can recall, applying them to a similar job. You not only will accomplish much more satisfying results, but you will never again lack full respect for the hand hack saw blade which is one of the most ignored and misused tools today. You will never again take for granted that you can "get by with an all-purpose blade."



typical problems which occurs with improper use of this design is that the peaks and valleys of these waves of teeth become unevenly worn.

Blades Of Different Qualities

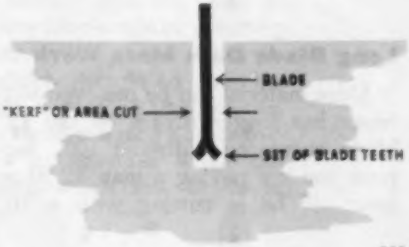
Saw blade manufacturers supply blades in a variety of "qualities" from standard to premium types. The premium blade is made of special alloys designed for unusually tough metal cutting jobs plus long hard service. The standard blade is made of low alloy, high carbon steel to satisfy the requirements of general work.

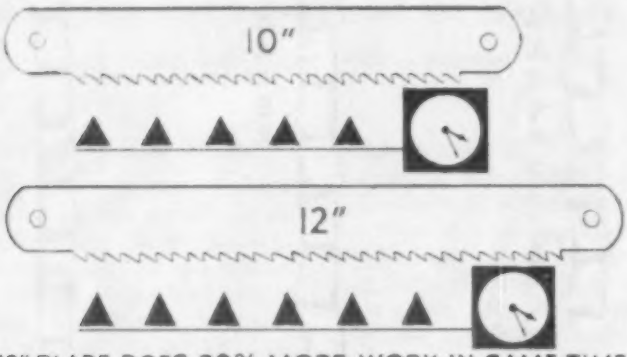
You have your choice of flexibility. The flexible blade is hardened on the cutting edge only. The back is left with some spring temper. Such a blade is less likely to break than the all-hard blade, but may not give the satisfaction of the latter used under controlled conditions by a skilled worker.

Four Factors Control Choice

No matter how skilled the mechanic, he cannot do the best job without the correct blade. Since there is no such thing as an all-purpose hack saw blade, he must consider four important factors, two of which can be standardized while the other two are carefully selected for every job. The four factors are: 1—Thickness and width of the blade; 2—Length of the blade; 3—Number of teeth per inch, or pitch; 4—Type of blade with reference to alloy and heat treatment.

The first factor is already covered by the manufacturer. The thickness and width of hand hack saw blades have been standardized. The blades





12" BLADE DOES 20% MORE WORK IN SAME TIME

you purchase generally will be 0.025" thick and ½" wide, except for special blades required for jobs not common to the average shop.

More serious consideration is warranted for factor No. 2, the length of the blade, before you establish your own standard length. Your choice can be a compromise between cost of blade and speed of production. Standard blades are supplied in 10" and 12" lengths. The price differential between the two is almost exactly proportional. So, the question is, why pay more for a couple of extra inches on the blade?

Long Blade Does More Work

More material can be removed with fewer but longer strokes on the 12" blade compared with the 10". Suppose you are paying a man $2.50 an hour. If he is cutting with a 10" blade and you have him switch to a 12" blade, the man can remove 20% more material in the same number of strokes at the same rate if he uses the blade according to instructions. The worker, himself, will not be aware of the 20% extra effort. In fact, he will appreciate the better rhythmic swing he can get with the longer blade.

Now, if he can remove 20% more material for the same number of strokes at the same rate per minute, he is handling the job 20% faster. If your time rate is originally based on work done with a 10" blade, you are now getting $3.00 worth of work for the $2.50 you pay. Theoretically, you then gain 50c per hour, $20 per week, or over $1,000 a year in work value. And, what is the difference in blade cost? A popular premium "moly" blade is currently quoted at $52/100 for the 10" and $63/100 for the 12" length. That makes 11¢ difference per blade.

Select The Right Tooth For The Job

A general rule states that at least three teeth must be in contact with the work as a saw blade makes the cutting pass. This provides minimum support to keep from snagging the teeth and maximum cutting action with good chip clearance. But, proper tooth selection also is governed by the properties of the material as well as its thickness. Thin sections will require fine teeth to prevent binding or stripping. Yet, thick sections of stainless and some of the rare metals also will require relatively fine teeth but in a special alloy blade. On the other hand, brass cuts nicely with an economical carbon blade while its free-cutting, fine chip characteristics permit finer teeth than some materials like aluminum which tend to gum up. Aluminum is so gummy and requires so much chip clearance in the gullet of the saw teeth for efficient cutting that the three-tooth rule indicates a selection of almost maximum fineness. If many more than three teeth engage aluminum, they may load up too fast.

There Are Four Pitches Of Teeth

The number of teeth engaging the work is not the only consideration for proper selection of blades for the job, but a systematic approach to the right tooth selection is of great importance. Blades are furnished in four pitches: 14, 18, 24 and 32 teeth per inch of cutting edge. Beyond this, some manufacturers offer variations in the precise profile of the teeth. One, for instance, makes easy starting teeth at the front end of the blade so that a full "bite" will not begin at the start of a stroke.

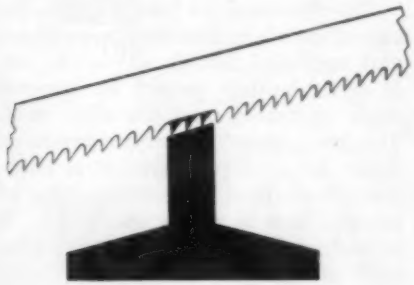
Coarse teeth cut faster under average conditions because the larger gullet can bite deeper and carry away the chips better. Finer tooth blades, however, are less likely to break under a given set of conditions—up to the point of becoming clogged.

A blade too coarse will snag and strip off the teeth. A blade too fine will cut slow, clog up, glide through the kerf or bind and break the blade, depending upon the ductility of the material you are cutting.

Which Pitch Of Teeth To Choose

General suggestions are summarized for each of the four pitches, but for specific work and greatest efficiency, refer to the tooth pitch chart.

Use a 14-tooth blade for cutting



3-POINT RULE

At least three teeth must be in contact with the work as a saw blade makes a cutting pass. With three teeth in contact, snagging of the teeth is avoided. But beware, for there are many other factors to consider when deciding which saw blade to use.

Practically every problem in back sawing

solid stock of ¼″ or larger cross section, heavy angles, beams, rails, and for soft materials where maximum chip clearance is needed.

Use an 18-tooth blade for sections of about 3/16″ to 3/8″, medium weight angles, channels, drill rod, machine steel, small solid stock, and for general shop use when the blade is used on a variety of jobs.

Use a 24-tooth blade for sections of about ⅛″ to ¼″, pipe, heavy tubing, light angles and channels, large wires, small drill rod, and heavy gage sheet metal.

Use a 32-tooth blade for sections thinner than 3/16″, thin wall tubing, light sheet metal, and for hard or brittle materials which will not tend to gum up in the fine teeth. If your material is thinner than 0.094″, you will have to make the blade approach the work on a slant in order to engage three or more teeth in the work.

Beyond these general considerations for tooth selection, use the chart which is designed to compensate for different materials and shapes of a part being cut.

Which Type Of Blade To Choose

Factor No. 4 relates to the six general types of hand hack saw blades manufacturers produce. Each type of blade may show slight variations in characteristics according to the individual manufacturer's methods and specifications. You may already have some preferences without really knowing what they mean. Let's take a look.

The Standard Semi-Flexible Type is called an all-purpose blade, but skilled workers know better. It is hardened throughout, then tempered to a degree of flexibility to minimize breakage. This is a tough blade which can stand considerable abuse, but there is a sacrifice of cutting quality. It is recommended for maintenance men and home utility use.

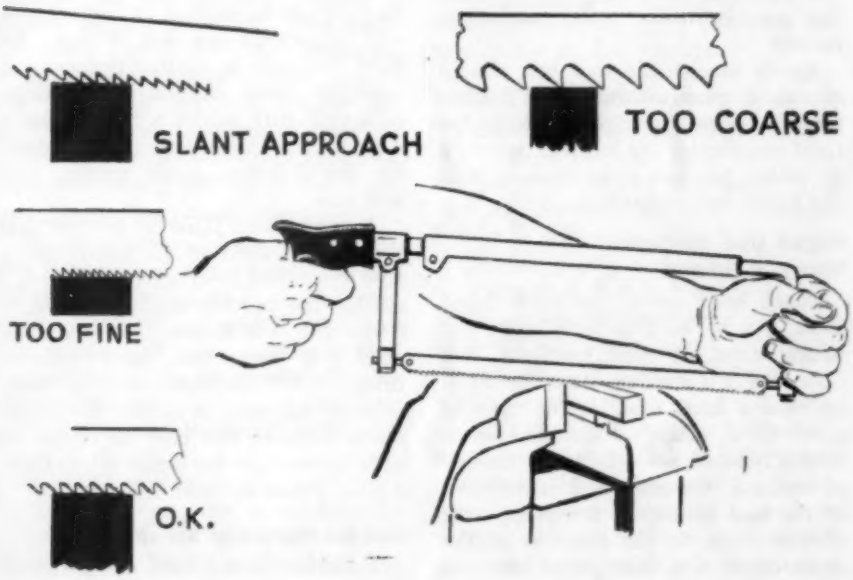
The Standard Flexible Type is made of tungsten alloy steel with the back of the blade soft, teeth hardened and tempered. It is recommended where work cannot be held firmly, or when sawing in an awkward position. It is favored by plumbers, electricians and garage mechanics.

The Standard All-hard Type is designed for use in machine shops where tool steel and harder alloys are cut. It is moderately priced for general work on carbon and low-alloy steel. The hard structure invites breakage if not handled properly. It is hardened throughout for better cutting of straight lines in rigidly held work. It is favored by skilled mechanics who work at a bench vise.

can be related to the blade's teeth

The Premium Flexible Type is made of high-speed "moly" steel and is the true shatterproof blade. The soft tempering of the tough alloy in the blade back provides the ultimate in safety for both skilled and inexperienced operators. Its hardened tooth edge is designed for cutting the hardest materials. Ask for specific cutting instructions on this one.

The All-hard Molybdenum Type is similar but designed for more precise



The blade cannot do the job alone; good hack saw frames, along with intelligent clamping, are needed

cutting of straight lines in high-speed steel, carbon tool steel, chrome, chrome-nickel and other extra hard alloys. Give this one only to a skilled operator when the workpiece is firmly held for cutting.

The All-hard Tungsten Type is the third premium blade made for cutting the toughest materials with the greatest precision and efficiency. Few common cutting jobs would warrant this blade, but it is effective on stainless, high manganese steels, and on certain hard-to-machine bronzes. Call in your most skilled mechanic to use this one and make certain he follows the manufacturer's recommendations exactly.

Every mechanic's tool box should contain a good assortment of blades. Only by using the right blade in the right manner for the job will the work go faster, the job come cleaner, and the blade last longer.

Right Use Includes Many Factors

Hand hack saws, like other hand tools, can be used in both right and wrong ways. A good mechanic will be aware of a number of factors when he uses a hack saw: 1, the type of material; 2, shape of the workpiece; 3, the type of saw blade; 4, number of teeth; 5, the style and adjustment of the saw frame; 6, the positioning of the work; 7, the position of the operator; 8, the direction of the cutting stroke, and 9, the pressure applied. All these are factors relating to the skill of the operator, the quality of his work and the cost of doing the job.

Good Blades Need Good Frames

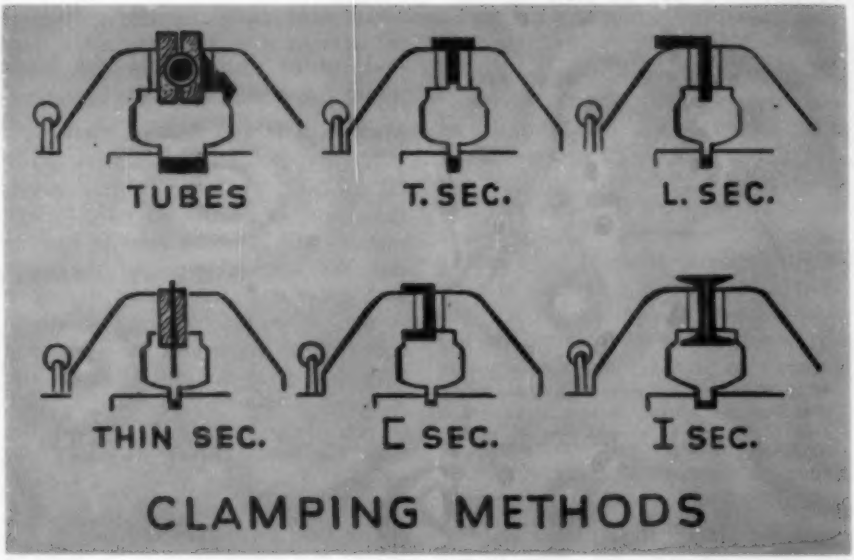
Mechanical skill and shop efficiency demand a good saw frame. The careful selection of a quality hack saw frame may prove more important than any special tricks in handling. A good frame must be sturdily constructed to avoid bad alignment, crooked cutting, binding or twisting of the blade.

The hacksaw blade should always be properly tensioned. A loose blade will whip and cut out of line. All hard blades can shatter if loose. A too-tight blade can have the frame pins pull out. Select a frame that is easy to tension and simple to adjust for the different blade lengths you will use.

A good frame must be comfortable to use. It should fit the hand with a nice grip that feels easy and secure during the cutting stroke. A flimsy frame will ruin a good blade and the work. A frame too heavy will be tiring. Select the frame with as much concern as you have for the right blade because the best of blades is little better than the worst if you have a poor frame to hold it.

Cut On Forward Stroke

Hand hacksaw blades are designed



to cut normally in a forward stroke, away from the operator. Rarely would work in an average shop require a pulling stroke. Therefore, you insert the blade with the teeth pointing away from the handle. One exception would be for soft, non-ferrous materials when the blade is reversed in order to apply a full pulling stroke with minimum pressure on the work.

Use Moderate Pressure

In either case, do not bear down any harder than is necessary for the particular material to cut. The saw teeth must cut on each stroke forward, otherwise they will be dulled immediately. The toughness of stainless and the rare metals requires more pressure to keep the teeth cutting instead of sliding.

Start the cut with the teeth running *off* a sharp edge, never into the edge. Begin with light pressure and a steady, full length stroke. Nibbling at the start of a cut just to make a notch will also nibble away a few teeth on the blade. You can start a notch with a file, then cut with the saw blade on full strokes.

Hold The Work Firmly

Clamp the workpiece rigidly in a vise. If not, you may twist and break the blade or strip off the teeth. The vise usually will be best at elbow height for efficient work. But, if it is a delicate workpiece, raise the vise to a position near eye-level. If possible, clamp the workpiece with its broadest side up to permit the use of coarser teeth for more efficient cutting.

Hold the saw firmly with both hands to gain steadier and straighter cutting with full control of the downward pressure. Use a light touch in starting the cut. Make your strokes slow and even until you have cut a

40 to 60 strokes per minute is ideal. It is vital that the worker develop a smooth, even stroke of the proper rate to work efficiently.

groove deep enough to support and guide the blade. If you must start at a corner, make a very light stroke until the cut is deep enough to support a length of at least three teeth before you bear down on the stroke. Continue with a light stroke, however, for tubing and thin materials.

Make The Teeth Bite

For normal work, bear down on the forward cutting stroke enough to feel the teeth biting along the full length of the blade. Once a supporting groove is started, you may wear the teeth unevenly if you do not take advantage of the full blade length. If you make short jabbing strokes at the beginning, then try to take a full length stroke, the worn length of teeth will cut a kerf too tight for the fresh teeth and the blade may bind on the full stroke.

At all times, avoid letting the blade merely slide lightly over the material. This will dull the teeth quickly.

Too much pressure strains the teeth and causes distortion in the blade without speeding the work.

Maintain Right Speed Rate

Normal speed will run from 40 to 60 strokes per minute. Faster speeds than this, especially on hard, tough metals, will generate enough heat to dull the cutting edges of the teeth and may stall the blade during a stroke. When establishing your stroke speed, it is important to develop a smooth, even stroke of the proper rate. It is not satisfactory to make a quick stroke, then hesitate to extend the time for the proper number per minute. You must develop a regular rhythm forward and back in continuous motion at the desired rate.

Lift the blade slightly to remove all pressure on the return stroke. You will dull the blade by dragging it back through the cut.

If the blade should break during a cut, do not start a new blade in the same cut. Reverse the workpiece and cut through to meet the first cut.

Keep Blade Tight

A new blade of the flexible type tends to stretch a little after initial use. A loose blade will not cut straight, therefore you must increase the tension of the new blade after a few cuts.

Check the condition of the saw frame occasionally, particularly at the pins which hold the blade. If any parts are loose or out of alignment, they should be adjusted immediately, or replaced, in order to perform the best work.

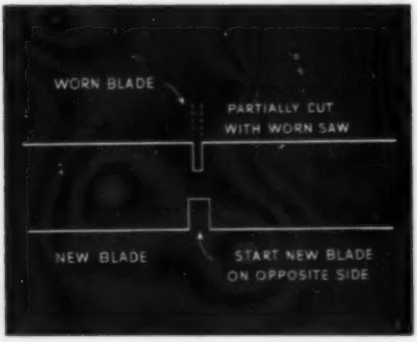
With everything in good order and the right type of blade to do the job, a final word can sum up the problem

of getting efficient work from hand hack saws. Sawing is a method of metal removal by means of a great number of miniature cutters—the teeth on the saw. Selection of the right teeth will make the cut a clean and rapid operation—if the tool is handled with a reasonable degree of intelligence.

Problems To Anticipate

Obviously, with all that can be said about hack saw blades and their proper use, an infinite number of problems can occur through misuse or lack of understanding. The most typical of these problems are listed below for quick reference. While each problem can occur from one or more of the specific causes, it often happens that a problem as it occurs in the shop comes from a combination of causes and the correction of a single cause will not always solve the total problem. Consider each possibility for a problem and determine if more than one cause will apply. Then, make corrections for each to arrive at a satisfactory solution.

The following discussion of causes and cures applies to the common problems. You may add others from experience with different saws, different materials, and different shop incidents.



Blade Cuts Out Of Line

At least three common errors relate to this problem. If you try to use a blade beyond its normal useful life, the set may be worn off the teeth and you may find it impossible to cut straight.

If a good blade is carelessly tightened in the frame, it will tend to twist and cut out of line. If the frame is out of alignment, or if it is not sturdy enough to resist bending or twisting under pressure, get a better frame.

And, if you bear down too hard on the work you cannot retain a true cut. Use only enough pressure to make the teeth bite into the material. Another possibility not to be blamed on the operator is "hard spots" in the material.

One cause which is almost too obvious to mention, but still one to watch for, is that the workpiece is not properly clamped.

Teeth Become Dull Or Rounded

This can become a serious problem if you get in a hurry. The blade slips instead of biting as it should. Do not exceed the proper number of strokes per minute. Another cause for dulling, however, is that there is too little pressure applied to the cutting stroke. At the same time, avoid all pressure on the return stroke.

Sometimes, a totally inexperienced worker may install the blade with the teeth pointing backwards. One stroke like this and you're finished. Always check the direction of the teeth, making them point in the direction of the forward cutting stroke before using the saw, if there is a chance that anyone else has used the tool before.

Finally, if someone has selected the

wrong type of blade for the material being cut, you can dull the teeth when nothing else is wrong. Besides checking the selection chart for the right teeth for the job, refer to the discussion on types of blades for the material you are cutting.

Teeth Break Or Strip Off

Wrong tooth selection can cause this. If the teeth are too coarse for the workpiece thickness and you have less than two or three teeth in contact, you can strip off the teeth as fast as you can take a stroke. Approaching thin material or a sharp corner at the wrong angle will do the same thing. There are just not enough teeth in contact to support normal pressure.

On the other hand, teeth too fine for the job will tend to clog and you can burn the teeth if they don't strip off. Use coarser blades generally for soft and gummy materials, but not to the point of less than three teeth in contact.

Even with correct teeth for the job, however, you can strip them off by applying too much pressure. Use just enough pressure to make the teeth bite, not enough to make them bite off more than they can chew.

Breaks Along Cutting Edge

You can account for this problem with almost every source of trouble that is a symptom for the other problems. Insufficient tension will allow the blade to twist and buckle. One more push and the blade snaps. When you install a new blade, tighten the thumbscrew just enough to make the blade sing a low-pitched musical "twang" when you thump it with your fingernail. Do not tighten more than this or you may break out the pin holes at the ends of the blade.

Starting a new blade in an old cut will make the wider set of new teeth bind in the restricted saw kerf made by a previously worn blade. This condition may cause the blade to bind enough so that it snaps on your first stroke. Always start a new blade on the opposite side and cut through to a cut started by a used blade.

Teeth too coarse for hard material can cause abnormal resistance and binding to the point of breaking a blade. Besides having a minimum of three teeth in contact, you also must select finer teeth for certain materials (see selection chart) which cut easier with finer chips.

Improper clamping of the workpiece frequently results in broken blades. In the first place, the work must be held rigidly for the best quality cut. If this is not possible and you must work in an awkward position without the workpiece being held rigidly, use a flexible type blade. Otherwise, clamp the work securely in a vise and let the cut off end drop to the floor.

If the work is held at both ends, add support near the cut to avoid the workpiece sagging and binding the blade.

In all cases, be careful to take full length positive strokes forward by holding the saw frame properly with both hands. This is necessary insurance against damaged teeth and broken blades even when other factors are in your favor.

Once you learn to select the right

HAND HACK SAW TOOTH PITCH CHART

TYPE OF MATERIAL	Number of Teeth Per Inch For Section Thickness or Rod Diameter				
	Above 3/8"	7/16"-1/4"	1/4"-1/8"	1/8" or less	Strokes per min.
Alloy Steels	14	14-18	24	32	45-50
Aluminum	14	14-18	18-24	24-32	60
Asbestos	14	14-18	18-24	24-32	60
Babbit	14	14-18	24	32	60
Brass	14-18	18	24-32	32	60
Bronze	14-18	18	24-32	32	60
Cast Iron	14-18	18	24-32	32	60
Copper	14	14-18	18-24	24-32	60
Fiber	14	14-18	24	32	60
Hard Rubber	14	14	18	24	40
Lead	14	14	18	24	60
Mild Steel	14	18	24-32	32	60
Plastics, hard	14	18	24	32	60
Plastics, soft	14	14-18	18-24	24	40
Rare Metals	14	18-24	32	32	40
Tin	14-18	18	24-32	32	60
Tool Steel	14	14-18	24	32	45-50

SHAPE OF WORKPIECE	Number of Teeth Per Inch For Section Thickness or Rod Diameter				
	Above 3/8"	7/16"-1/4"	1/4"-1/8"	1/8" & less	Strokes per min.
Angle Iron	14	14-18	24	32	60
Bolts	14	14-18	18-24	32	60
Cable	—	—	—	32	60
Channels	14	14-18	24	32	60
Conduit	—	—	—	24-32	60
Drill Rod	14-18	18	24-32	32	40
Iron Pipe	14	14-18	18-24	32	60
Rails	14	14-18	18	—	40
Sheet Metal	—	18	24-32	32	60
Structural, steel	14	18	24	—	60
Structural, non-ferrous	14	14-18	18	—	60
Tubing, ferrous	14	18	24-32	32	60
Tubing, non-ferrous	14	14-18	18-24	24-32	60
Tubing, stainless	18	18-24	24-32	32	40

blade for the job, a blade of most appropriate type and correct pitch of teeth, you'll see a big difference in the cost and quality of work performed. You will be quick to say there is no such thing as an all-purpose hack saw blade any more than all-purpose types of other good cutting tools.

We wish to thank the following companies for their special help in preparing this article: Atkins Saw Div., Borg-Warner Corp., Indianapolis 25, Indiana; W. O. Barnes Co., Inc., 1295 Terminal Ave., Detroit 14, Mich.; Capewell Manufacturing Co., Hartford 2, Conn.; G. W. Griffin Co., Franklin, N.H.; The Henry G. Thompson & Son Co., New Haven 5, Conn.; Ladish Co., Cudahy (Milwaukee Suburb), Wis.; Nicholson File Company, Providence 1, R.I.; Victor Saw Works, Inc., Middletown, N.Y.

WHO SAID SAW BLADES WERE UNIMPORTANT?

Man has been fighting the saw blade problem longer, perhaps, than most any other tool problems you encounter. Man has been improving on saw blades and their teeth ever since the first prehistoric genius figured that if his jagged teeth could chew through tough food substances, a jagged edge of a flint rock could chew through wood.

Although nature had developed the right teeth for the job millions of years ago, man is still in the middle of the process of developing improvements in saw blades and saw teeth. We continually receive announcements of new patents or minor improvements just developed —and they still haven't licked all the problems yet!

When it comes to teeth, it may be that man will never catch up with nature's spontaneous and automatic compensation for every chewing or cutting problem. Science has found that fossil teeth are a definite clue to habits and mode of existence for prehistoric animals. Prehistoric man must have been intelligent enough to make some correlation because saws date from the Neolithic age. Their principle was utilized shortly after the origin of the axe and knife. The most primitive appear to have been made from tapering flint crudely sharpened to a thin edge. By serrating its edge, a knife was found to produce a saw cut when scraping away particles of the material being worked.

Wood, fibrous shells, bone and soft stone were the earliest sawed materials. With the appearance of copper, bronze, and ferrous metals, saws moved rapidly toward wider use. These materials not only broadened the field of things to be sawed, but constituted new materials for saws, themselves. Relative hardness of saw blade versus substance to be cut was a matter of selection and test.

Hardening saw metals was not immediately discovered. Prime importance was centered on good "toothing." To keep blades reasonably thin, yet stiff, they were made wide—a characteristic still employed in many modern blades. Modern steels and hardening methods combine sturdiness and desirable flexibility without permanent loss of straightness.

As the practicality of saws for cutting metal became more apparent, the need for blades of narrower type became equally important. Much

sawing must be done in close quarters, limiting the practical width of a blade.

On the other hand, excessive flexibility of the narrow blade became an obvious drawback to straight-line sawing. This hindered application of the desired thrust on a blade. The invention of the saw frame not only provided the necessary backbone for the narrow saw blade, but saved a tremendous proportion of steel in the manufacture of blades. Rigidity, permitting application of desired thrust, was attained by means of the thumb screw tension adjustment on standard hack saw frames.

New materials to cut and new materials for making blades present more of a challenge to future developments than anything we've seen in the past. There has been some standardization of sizes, styles and types of blades. But, as industrial progress accelerates, we anticipate the need for developments not yet conceived in the primitive metal cutting process called sawing. We would look for cutting tools utilizing the saw principle in new forms with no resemblance to present day saw blades.

Even with the relatively little progress already made, there is an infinite variety of choice for the modern worker. There are "standards" and "specials" to fit most every sawing need. From what is already obvious on the market and in use by over 97% of all metal working shops, you need a wide variety of blades for the variety of jobs being handled. No one blade will do all jobs and many of them—both blades and jobs performed—require much skill and attention to technical details. The feature article in this issue on hand hack saw blades points up these details along with techniques for handling saws and problems to anticipate.

Who said saw blades were unimportant? We found in a recent survey that over 97% of our plants were vitally interested.

Part 2, Power Hack Saws, will appear in the August issue; Conclusion, Band Saw Blades, will appear in a fall issue.

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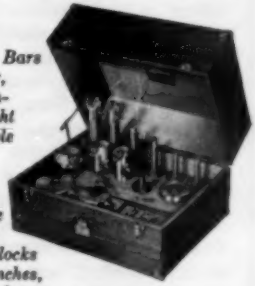

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GROUP OF WHEELED punch presses. Operator moves them into position and then goes from machine to machine with part.

Portland Firm Increases Production and Cuts Costs on Shear, Brake and Press Work . . . they

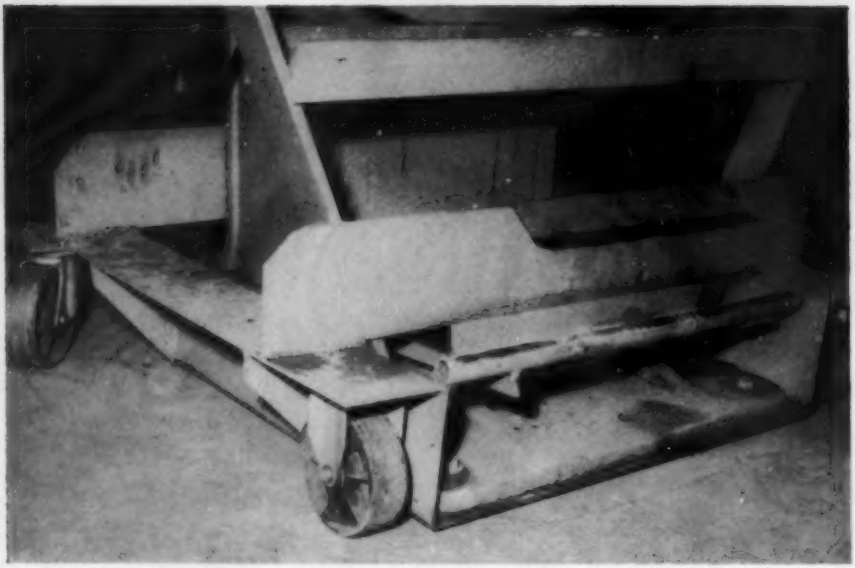
PUT THEM ON WHEELS!

By **Howard E. Jackson**

■ Sandberg Mfg. Co., of Portland, Oregon, has offset its rising labor costs by mobilizing its shears, press brakes, and punch presses in order to eliminate much material handling by making production of its furnaces more consolidated and flexible.

Sandberg fabricates a line of coal, wood, oil, and gas warm air furnaces for distribution throughout the northwest states. The residential and commercial furnaces range from 80,000 to 1,500,000 B.T.U.

There is no hand-carrying of any part in the plant. Fork lift trucks and a multitude of wheeled carts take care of that. The carts are used right down the line, receive material as it is cut on the shear, transport it to the punch presses, receive it



DETAILS of platform and bracing, as well as the two fixed, and two moveable wheels are shown in this closeup of one castered punch press.

from the presses, take it to the press brakes, to welding and so forth. The operators in each case lift the part from one wheeled cart, place it in the machine and when through bending, braking, forming, et cetera, set it in another wheeled cart. Foreman, and even top brass, who must "walk" the length of the factory use bicycles, so you might say the company is wheel-minded. Thus, it is not surprising that five years ago it hit upon the idea of attaching wheels to its shears, press brakes, and punch presses.

Not all shears have been equipped with wheels, only the principal 54" shear used for cutting a variety of parts from a dozen or more bundles of 26 through 20 gage cold rolled steel. These man-high bundles of steel are set along one wall, and some parallel to them making a partial second row some 20 feet away. It was found more reasonable to put wheels on this shear, and move it to the bundles of steel than it was to get a fork lift truck to move the bundles of steel to the shear. This is especially so for Sandberg's type of production (seasonal, short and long runs throughout the year).

This shear is equipped with an automatic tripper in the back of the machine for dropping sheared pieces into a pile of a wheeled cart beneath

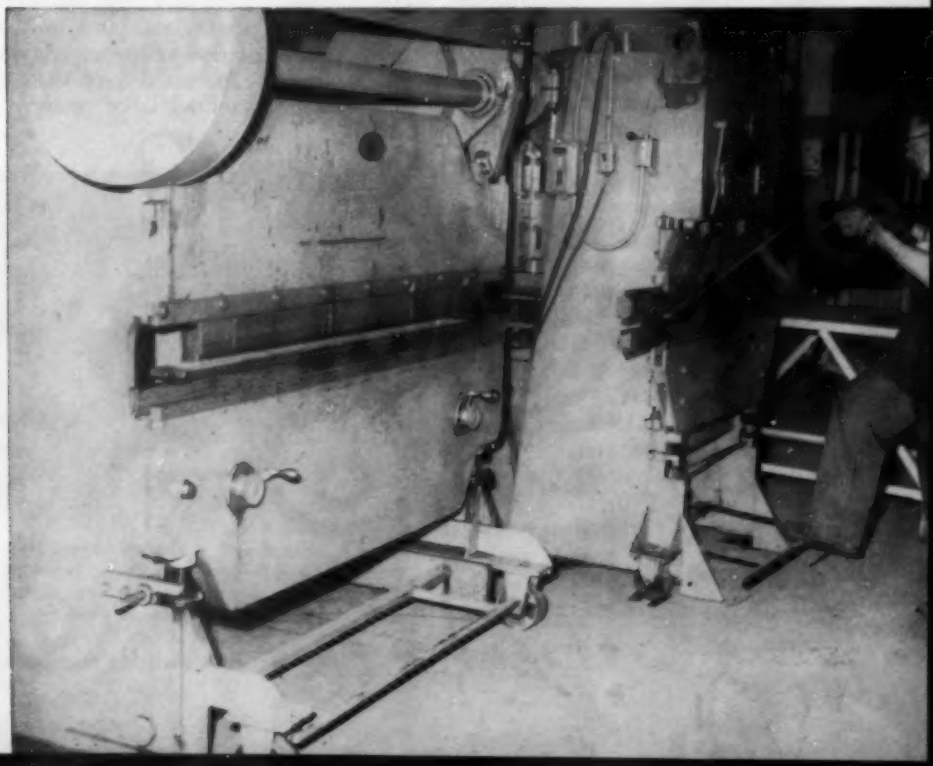
it. The material slides through the shear to the stop on one angle iron (fixed) but its opposite edge rests upon a second angle iron which can pivot downward. When the shear is tripped it automatically releases a tripper on this second angle iron, allowing the sheared piece to fall in place, as the angle iron turns downward. The shear operator needs no helper.

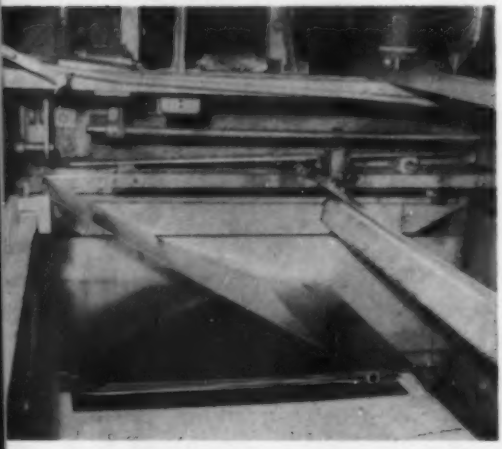
Other shears are not wheeled, either because they are too large and the warp of the floor would affect the blades, or because it is unnecessary.

The punch press department has 21 presses, 11 of them on casters, capacities of from 20 to 50 ton. The wheeled presses were equipped with heavy gage platform bases and bracings and the punch presses rest on them. Each has four casters, two fixed, two that turn (same for shear and press brakes).

The presses are wheeled in line, or in a circle according to most efficient production of current parts. One operator moves from one machine to another with the piece, perhaps moving to three or four or five punch presses performing various operations before again placing the part on a wheeled cart. This may be taking place on a number of groups of wheeled and stationary punch presses, the castered presses being clustered around, or to each side, of one or more stationary machines. It is easy to see that a

TWO WHEELED PUNCH PRESSES moved opposite two stationary press brakes permit an operator to take piece from one press brake to another for various operations. Wheeled carts, before and after pressing, handle the work material.





HOW SHEARED SHEETS are automatically stacked onto a wheeled cart. Stop at left is on fixed iron bar. Trigger is at end of moveable angle iron at right. Trigger here has tripped, the bar tilted, allowing the sheet to fall in place.

tremendous amount of material handling is saved by this system.

In the group of four press brakes two are stationary, two on wheels. A 60" Verson and a 72" Dreis and Krump are stationary. The 4' and 72" Dreis and Krumps are on wheels. When small pieces of material are to be broken up the wheeled press brakes are moved in close to the stationary press brakes, leaving just enough room for one operator to remove the part from one wheeled cart and move it from one press brake to the next, then placing the part on a second wheeled cart. The wheeled press brakes are spotted opposite to the stationary press brakes, with the wheeled carts opposite each other, just outside the rectangle of press brakes. Thus the operator works in a little closed circle, utilizing one, two, three or four press brakes as the case may be. The wheeled brakes are pushed back to make more room when braking large parts. In both cases one operator does all press brake work. There is no setting down, or picking up of the parts.

All punch presses and all press brakes have their own dies, for standard operations. No labor is involved in changing dies when a run is completed.

The body department has its own 12' press brake, and three punch presses ranging from 50 to 125 tons; however, none of these are on wheels. The wheeled machines are all in the casing department.

By using the wheeled and castered shear, punch presses and press brakes during the past five years production costs have not increased even during a period of increased labor costs.

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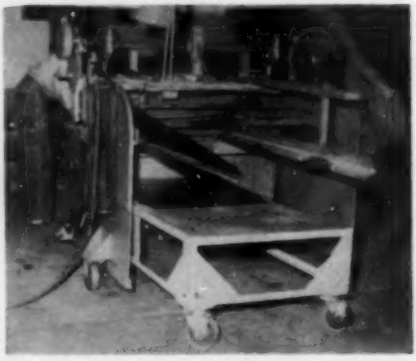

SHEAR, background, is also on wheels. Note setup of cart at back of shear receiving sheared piece as it is tripped by trigger at far end of channel iron at right.

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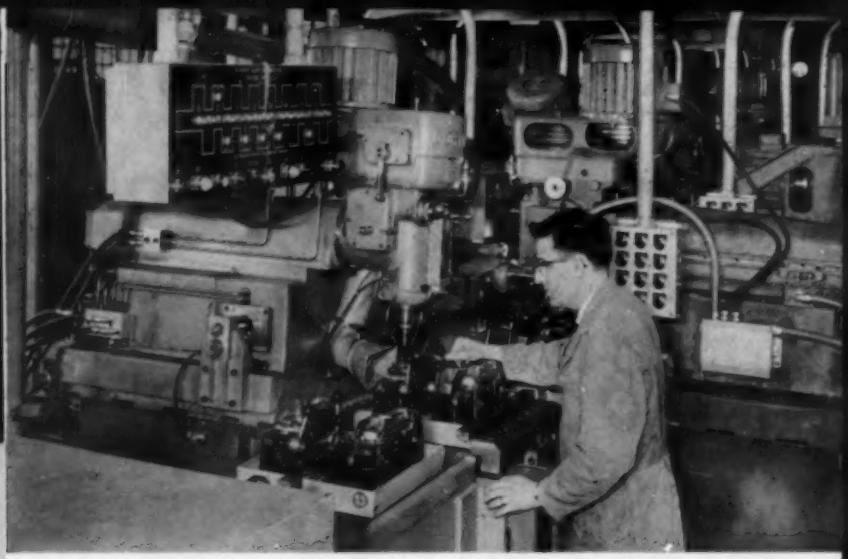


One of two, 16-station transfer lines built to machine receivers for NATO's new official gun, the Springfield M-14. At this station the operator loads a new forging on one fixture, removes finished workpiece from second fixture, and transfers half completed workpiece from fixture No. 1 to fixture No. 2 ahead of the first work station.

By **Darrell Ward**
Engineering Editor

■ The receiver of the new Springfield M-14 Automatic Rifle (official gun for NATO) requires a total of 110 operations, including hand work and finishing. Machining operations include vertical and horizontal milling, angular milling, undercutting, drilling, profiling and duplicating. Of these, 32 operations are now performed on two transfer machines built for the Winchester Western Division of Olin-Mathieson Chemical Corp. by the George Gorton Machine Co. Each of the two transfer machines contains 16 stations. One receiver comes off the line every 45 seconds.

This new concept of transfer machine for manufacturing small parts replaces 32 different machines with two, and eliminates related problems in tooling and materials handling. A unique feature of the new develop-

Report On An Unusual Machine

Standard Machine Heads And Tracer Control Show Trend In Transfers

Simplicity, attention to details pays off for Gorton's designers

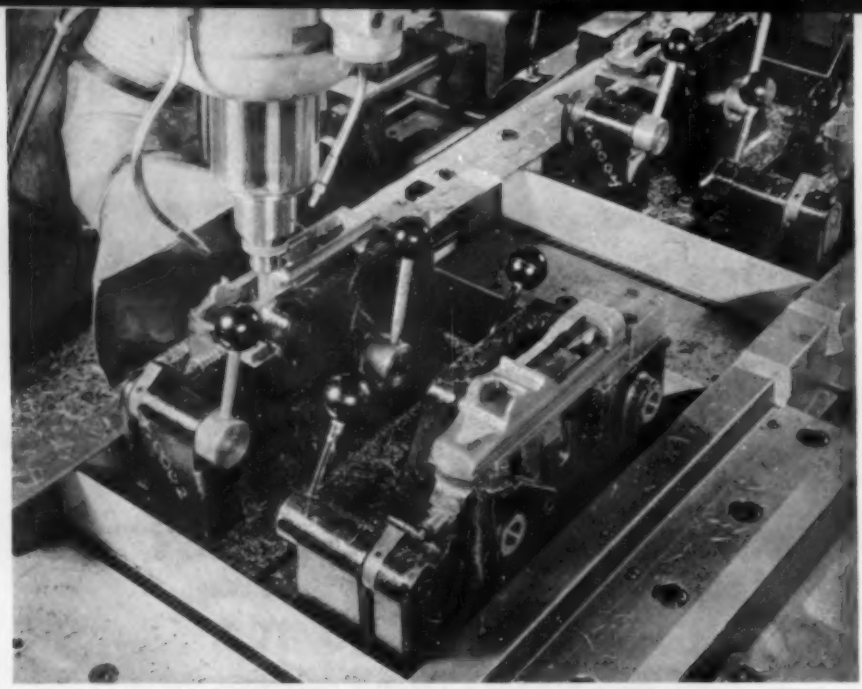
ment is that every one of the 32 stations consists of a standard head unit, any of which could be replaced or relocated for other purposes, and every station actually is a unit in itself. A simple over-and-under chain conveyor transfer feeds the line.

Any station can be as far out of alignment as ⅛" for practical transfer of holding fixtures, yet machining tolerances range from ±0.0005" up to ±0.015" in various operations, approximately 75% of allowed tolerances specified for the workpiece. Each work station is a separate operation with locating and clamping integrated in the base of the machine. The workpiece platen and holding fixture is slightly lifted from the conveyor and held rigidly in the machine after each index. Indexing time is 3 seconds.

The unit design approach and utilization of standard machine components for minimum design and building costs was an original design concept at Gorton, and a major factor leading to the contract. The unit design in-line transfer type machine is unique in the small arms field, but the obvious advantages appealed to the tooling engineers of Winchester.

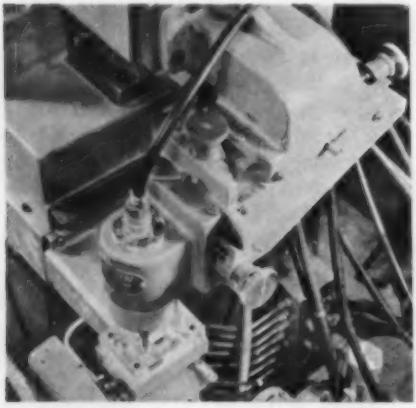
The workpiece material is resulfurized steel with a Brinell hardness of 223. The forging, as presented to the machine, measures 1-11/16" x 2-5/8" x 7-7/8" and weighs approximately 2-lb. 7-oz. Approximately 1-lb. 1-oz. of material is removed in the 32 operations.

Three different faces of the part are presented to the cutters. Each part goes through each of the two machines twice, receiving 8 operations on each pass, 16 at each ma-

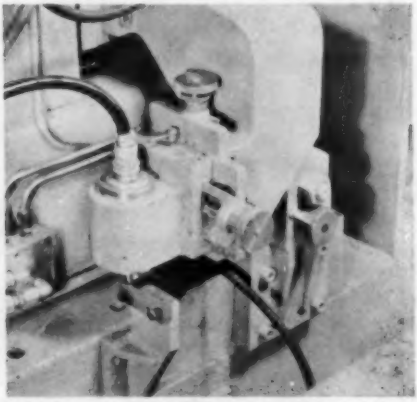


Rough forging ready for first operation and partly machined workpiece in cycle on operation No. 9 at this transfer machine. Hand levers control cam, locks against button located workpiece.

TRENDS IN TRANSFERS continued



Tracer mounted to the ram slide of Station No. 7. This 360° tracer head has micrometer adjustment in three directions for fine setup purposes. The template platform is mounted to the non-moving slide unit.



This tracer on Station No. 32 controls movement of the vertical slide.

chine. Each conveyor platen carries two fixtures. There are 43 platens per conveyor, a total of 86 fixtures.

Each fixture has been zeroed in by auto-colminator for precise location. Each platen is individually located at each work station and locked in position by hydraulic cylinders. The relation of one platen to another is not required anywhere along the line.

Cutters for all operations but two are made of M-3 hi-speed steel, the two exceptions being solid carbide because of depth of reach into the part and depth of cut taken.

All work stations, following the true building block concept, are similar whether horizontal or vertical because of the standardized use of Gorton 1-22 Mastermill heads. These heads are mounted at many different angles in the two planes to standardize also on cutters wherever possible.

Tooling is a basic Scully-Jones Toolitrol system with two spares for each tool in operation. It is not known yet what tool problems may occur after the production shakedown period, but in pilot runs it seems that one tool man and two operators can keep both lines running without serious problems.

To check cutter breakage, electric eye probing stations were installed to inspect automatically when the preset tools retract to "home" position.

Gorton made prolific use of their electro-hydraulic series of automatic tracing devices for profiling and for duplicate milling with a vertical end mill. The latter is one of the most interesting operations and virtually unknown for transfer line production functions.

Machine No. 1 utilizes the 360° Auto-Trace electro-hydraulic tracer system at station No. 7 to mill the sight base section of the receiver. The feed rate of the operation is increased or decreased through the use of an "in-cycle regulator," a special control built into the tracer template. The template is made of Plexiglas with brass facing pieces. These brass pieces make low voltage circuit connections from the tracer stylus to various speed range controls. Through this control, the feed rate is slowed in sharp radius corners and increased on straight cuts and traverse motions. After completing a cut, the tool appears to race back to the start position over a previously cut face.

As many as 24 different feed rates can be controlled in this manner. A cutter can be made to dwell in corners long enough to relieve the springback in a cutter of a long slim shape, besides retiring to start position quite rapidly after a cut is made. A similar solution could provide for different depths of cut or for a cutting pass made through dissimilar metals or through differences in hardness of a given workpiece.

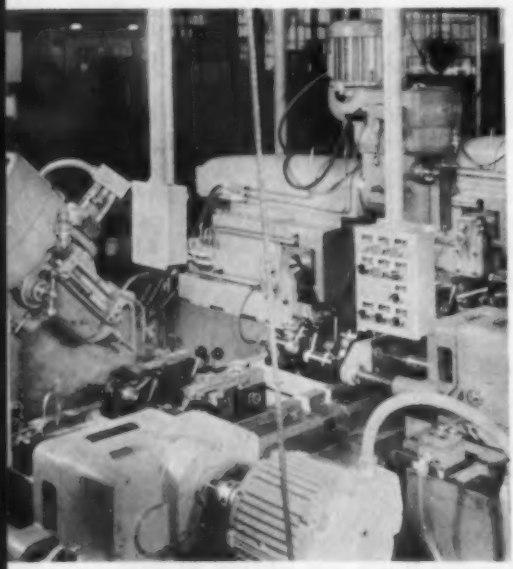
Machine No. 2 utilizes the 180° Auto-Trace at stations No. 25, 26 and 32. The tracers on stations No. 25 and 26 control the in and out movement of the ram slide. The tracer on station No. 32 controls the vertical slide movement.

The amount of material removed made a complicated chip removal problem which was handled in three different ways. During rough and finish cutting operations, chips are picked up through an exhaust system. As platens change direction in the

Why are only 32 operations performed here? It is a matter of optimum balance in space, cost and speed.

over-and-under conveyor, chips are dumped into a chip conveyor system at the far end of the machine. Finally, on the return trip to the unload station, a flushing arrangement cleans up the fixture and workpiece which drain and dry along the way.

The machines on the production floor each take up 16'x44' and together weigh approximately 188,000 lbs. There are 70 electric motors with starters drawing 149 amp. each on full load to deliver a total of 148 h.p. It takes 26 miles of electric wiring to connect the 380 push-button and selector switches, 448 contact blocks, 280 solenoids, 413 relays and 5,356 terminal blocks for the complete operation.

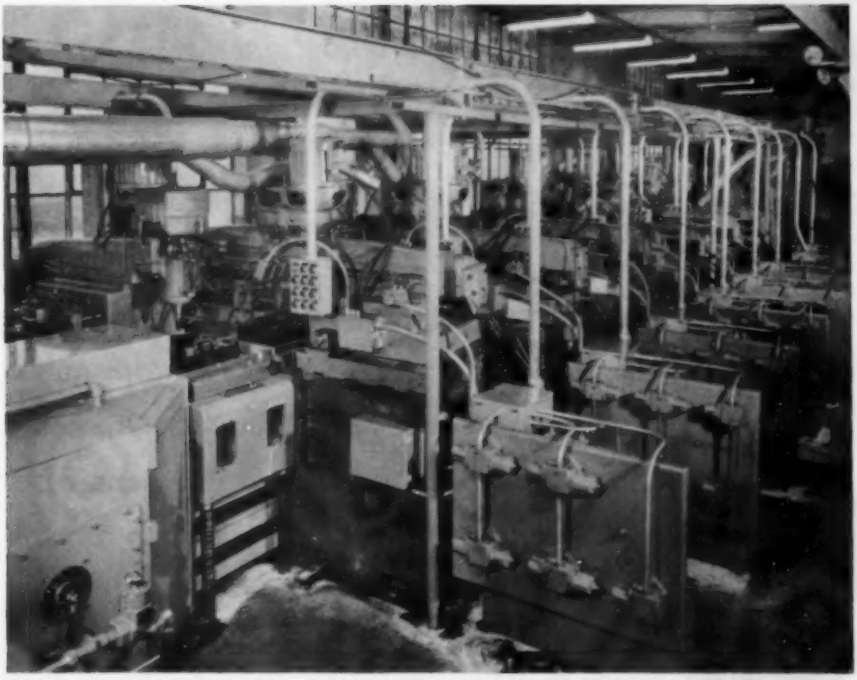


Drilling and milling stations located midway in the operations of Machine No. 1. Note the angle milling operation at the left side of the photograph.

A very clean and efficient operation is credited to the 17 mist-coolant units which supply the 32 stations of the two machines. The machines are built with a central lubrication system for slide units, conveyor, and such mechanical functions. Hydraulic tubing totals 3,000 ft. for the 780 gals. of hydraulic oil required. Hydraulic pressure for transfer is set at 600 psi, while the pressure for each station is set at 400 psi with the secondary set at 150 psi.

It requires 11 32-ft. trailers to move this equipment which was produced for a total cost of $640,000. A manual machine equivalent to each of the 32 work stations employed is estimated at about $12,500 without tooling or conveyor.

Gorton engineers said such a transfer machine would be feasible for installations of as few as four stations and could be applicable for any larger number up to the limits of space available. Since each station is essentially a distinct individual machine with



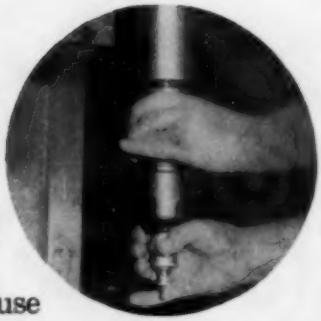
Another view of Machine No. 1, this time viewed from the end opposite the loading station. Note the use of the individual hydraulic systems (reservoir, pump, motor, valve body) at each station.

standardized heads, most of which are interchangeable, a row of work stations need not be connected within close tolerances and they can be located at any desired distance between.

When asked why only 32 of the total 110 operations on the workpiece were being run on the new transfer machines, the engineers replied that it was a matter of optimum balance between practical limits in space, cost, and speed of production. It is conceivable that all operations could be performed on such a line, but many would be impractical for one reason or another. • • •

How the machine looked at the mid-assembly stage. Note the unit or building block design utilized by Gorton's designers.

New Chuck



New chuck . . . with plastic Safety-Guard ring, prevents accidents and tool breakage because hands never grip collets or tools during quick changes while spindle is in motion. One hand lifts the locking ring—the other hand cups under the plastic Safety-Guard to control the collet. Hands stay away from sharp cutting edges, tools don't slip through hazard-conscious fingers. For replacement, operator lifts ring and inserts collet in one easy motion. Ring falls into place by gravity, and the cutting tool is ready. Here's increased safety and efficiency with multiple-spindle range for single-spindle machines on drilling, counterboring, reaming, tapping, and other sequence operations. Write for Bulletin No. 54-58.

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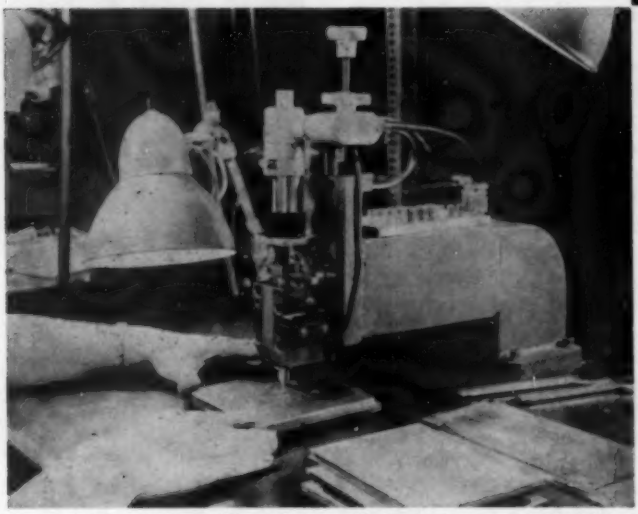

A special positioning "finger" is guided along an etched drilling pattern in fixture. As the finger drops into each indentation in turn, the operator touches a toe switch and a special carbide drill, located below the table, drills a hole in precisely the right spot. Unless the finger is in the center of the indentation, the drill will not operate.

NEW METHOD FOR PRECISION DRILLING CIRCUIT BOARDS DEVELOPED

■ A new method of precision drilling circuit boards with semi-automatic equipment has been announced by Librascope Division, General Precision, Inc., of Glendale, Calif. The new "gang" drilling produces circuit boards which are suitable for machines which automatically insert components.

The development of precise drilling techniques was necessary, according to Lewis W. Imm, president, when Librascope switched over to automated component assembly methods. Holes for mounting components by machine must be drilled with extreme precision to insure that the machines are able to place each lead correctly. Since the new equipment, designed by the division's Industrial Engineering Department, was installed, reject rates have dropped drastically, and output of drilled boards per operator has risen.

The semi-automatic drill consists of a table, a special positioning "finger" located above the table and an electrically controlled drill below the table.

An operator gangs five circuit boards by placing them in a special positioning fixture, a rigid metal plate. The surface of the plate contains a drilling "pattern" etched into the metal, with positioning indentations to correspond to the hole to be drilled.

The five boards are held in alignment by holes which are precision drilled before the circuit boards are etched.

The fixture, with the boards, is placed, metal plate up, on the drill table, and the special positioning finger is guided along the drilling pattern by the operator. As the finger drops into each indentation in turn, the operator touches a toe switch and a special carbide drill, located below the table, does the drilling.

The drill is completely automatic, rising at a controlled rate and spinning at a pre-set speed. The process is provided with safeguards, which prevent the drill from operating unless the positioning finger is located directly in the center of an indentation on the fixture's pattern.

All five boards are drilled at the same time, and the drill "bottoms" in the reinforced plastic backing of the fixture. At the completion of the "stroke," the drill returns to the rest position and the finger is guided by the operator to the next indentation.

Operated by toe switch, the special carbide drill located below the table, rises at a controlled rate and spins at a pre-set speed.

Precision circuit boards are required in a majority of the special computers and data processing equipment which Librascope produces for industrial and defense markets.

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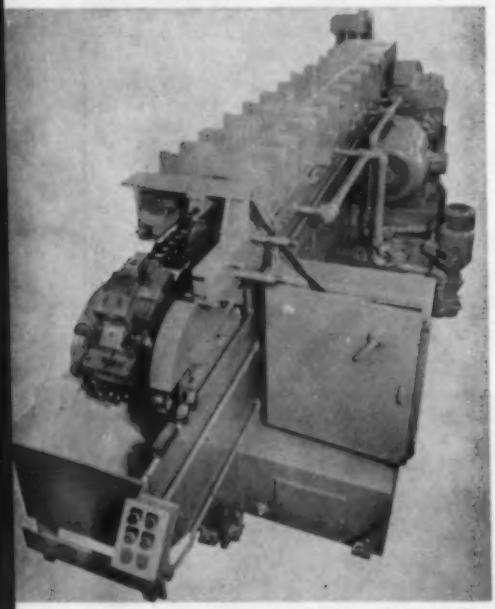
BROACHING MACHINE PERFORMS TWO OPERATIONS IN ONE PASS



Twenty ton continuous horizontal broaching machine with 144" stroke. Unfinished solids (foreground) and broached parts are automobile manual steering gear ball nuts which machine broaches in a single pass.

■ More and more U.S. and European manufacturers are investigating advantages of versatile new continuous horizontal broaching machines capable of high production with increased tool life.

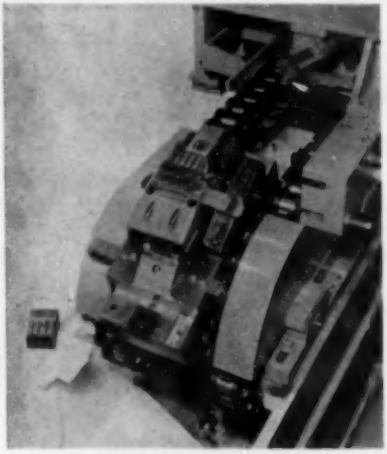
The machines utilize a powerful twin chain drive to pull workholding fixtures through a tunnel equipped with a series of broach cutting tools. Broaching is done in one pass through the machine and can be used to form any flat or irregular surfaces which parallel each other.

Angular surfaces can be broached in this manner through the use of fixtures which are arranged to tilt or index at the proper point during their travel under the broach cutting tools.

In addition to holding close tolerances, continuous broaching increases tool life in some cases up to three times that of conventional surface broaching.

Early this year, what was believed to be the largest continuous broaching machine ever built was one of the first Detroit-built products shipped this season via the St. Lawrence Seaway to Europe.

The 20 ton machine with a 144" stroke was designed by the Detroit Broach & Machine Co. of Rochester, Mich. to perform two separate broaching operations in a single pass on a manual steering gear ball nut for a European auto manufacturer.



Closeup of finished work and loading station. At lower left are solid and broached pieces.

Production of 182 pieces per hour is obtained from nine fixtures running

at 13.6 f.p.m. Increased production is obtainable by adding fixtures to a maximum of 18, and/or increasing machine speed through a change gear arrangement.

The new Detroit Broach continuous machine is powered by a 40 h.p., 750 r.p.m. 50 cycle motor.

A single operator feeds each part into a workholding fixture on the endless chain. Fixture locking, broaching, and unloading are automatic.

Broaches inside the tunnel, amply supplied with pressurized coolant, broach the top of the ball nut rack teeth. During a dwell section in the tunnel, a slide bar and cam act to tilt each fixture to permit precision broaching of the rack teeth from a solid as the chain moves through the tunnel. At the end of the cycle, the finished part moves by conveyor to the next operation.

Chips are automatically brushed away during the cycle by three intermittently spaced brush tables and carried from the machine by an automatic chip conveyor system.

Surface finish tolerances of the completed work range from 18 to 25 microfinish on all broach surfaces.

In addition, a special safety feature protects the machine and parts from damage during the operation. A safety limit switch flags the part to check the seating. If the part is seated incorrectly, the safety limit switch automatically shuts the machine off.

Further protection is afforded by push button control of start and stop and an emergency knee bar stop which is conveniently located at the operator's station. • • •

free literature

11

To receive copies of booklets described below, circle their identifying numbers on an Action Card, found opposite pages 80 and 208.

1. Solid Carbide Tools. Latest catalog No. 59 and price list covers Pre-Carb solid carbide tools. In addition to listing precision-made solid carbide tools, the catalog has a wealth of technical information—Techni-Data. Carbide micro tools, both standards and specials, are also listed. Precision Carbide Co., 292 Belmont, Paterson 2, N.J.

2. Induction Hardening Machine. The Cincinnati MG Inductron heating machine consists of a generator, a control station, and a heating station. But Cincinnati's building block versatility enables the customer to combine standard, unitized components into a compact machine to meet specific heating requirements. Main features of the machine are pointed out, with specifications covering control and heating stations, and motor generators. Literature offered by Meta-Dynamics Div., The Cincinnati Milling Machine Co., Cincinnati 9.

3. Machine Tools, Cutting Tools, Gages. Pratt & Whitney's 100th Anniversary (1860-1960) catalog contains 35 pages of P & W's up-to-date machines, tools, and gages to meet today's standards for speed with precision. Outstanding features, illustrations, and specifications are provided for products such as jig borers and hole grinders, P & W numerical control, rotary tables, tracer controlled milling machines, Potter & Johnston automatic turret lathes, cutting tools, gages, etc. Pratt & Whitney, Charter Oak Blvd., Hartford 1.

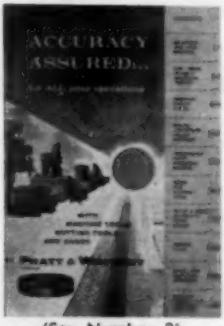
4. "Hirschmann Highlights" is the title of a new quarterly house organ designed to provide "periodic information on the newest developments at the home of High Precision Machine Tools for American Industry." The Factory of the Month department takes the reader into a metalworking shop and shows how profits are realized through use of high precision machine tools. Carl Hirschmann Co., Inc., 30 Park Ave., Manhasset, L.I., N.Y.

5. Ceramic Gages. Greenfield uses a very special type of ceramic for the manufacture of plain and threaded plugs and plain ring gages—high density, high purity aluminum oxide. Folder points up the advantages of using ceramic construction rather than steel or carbide for the gages. Greenfield Tap & Die Corp., Greenfield, Mass.

6. High Speed Steel Hacksaw Blades. This Silver Streak line is a companion to Atkins Silver Steel tungsten blades and is presented with descriptions and dimensions in a pocket size guide. Provided also are blade speed-feed recommendations for various metals, as well as instructions on how to select the right blade for the job. Atkins Saw Div., Borg-Warner Corp., 402 S. Illinois, Indianapolis 25.

(See Number 1)


(See Number 2)



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7. Expanding Collet, for internal chucking, needs neither special attachments nor adaptors. It fits present 5C equipment—lathes, milling machines, grinders, fixtures, etc. Thirteen-page catalog describes this featured collet, with prices, as well as other precision production tooling. The Dunham Tool Co., Inc., New Fairfield, Conn.

8. Tool Room Jig Borer is reported to offer a quick method of positioning for longitudinal and cross motion within .0002". This "6000" heavy duty milling, drilling and boring machine features spindle speeds in low range gearing, 30 to 250 rpm, and high, 270 to 1500 rpm. Literature is available from Atlantic Machine Tool Works, Inc., 549 Cedar, Newington, Conn.

9. Boring Bar. Disposable carbide screw-tip boring bar No. 1018 bores to "tenths" and holds the size. It is designed for holes from ¼" dia. and up. Prices and specs. in flyer. Arthur A. Crafts Co., Inc., 603 Newbury St., Boston 15.

FREE LITERATURE continued

10. Lapping Machine. The Speedlap is reported as offering productivity of grinding with the accuracy of lapping, achieving rapid stock removal on metallic and non-metallic parts. Folder points up by illustration and description how Speedlap's productivity is achieved—non-chargeable alloy lap plate, full wear control, etc. Machines are standard in sizes of 18", 32" and 48"; specials on request. Speedlap Corp., 8020 N. Monticello Ave., Skokie, Ill.

11. Abrasive Cutting Machines. The Speedcut models are provided with special motors to give the extra power needed to keep the wheel cutting at proper speed. Models described in brochure are manually or automatically operated, for dry or wet cutting, with air-operated power head or oscillating head, etc. Beaver Pipe Tools, Inc., Abrasive Machine Div., Warren, O.

12. Cutting Tools. Catalog No. 60 is a 68-page listing of an extensive line of cutting tools. Included are twist drills, reamers, end mills, countersinks, counterbores, carbide tools, and tool bits. Both a numerical and alphabetical index are features, as is an extensive section containing useful information. Chicago Latrobe, 411 W. Ontario, Chicago 10.

13. Automatic Recessing Tools. Recessing, grooving, relieving, necking, chamfering, back-facing or a combination of these or any internal machining requirements are done accurately with FR holder using form relieved cutters or tool bit holders, or with CF holder using long life circular form cutters. Dimensions and prices in folder from Erickson Tool Co., 34350 Solon Rd., Solon, O.

14. Profitable Cam Engineering, to a reported 2300% saving, is detailed in Bulletin No. 105. Chart shows method used, positions on cam, time required, and comparative operations. Eonic Inc., 464 E. Hollywood, Detroit 3, Mich.

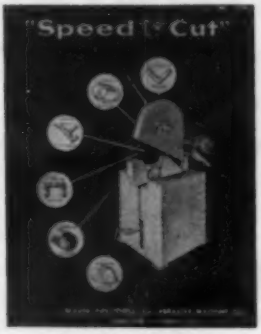
15. Drilling Machines, in four models, are illustrated and described in four-page folder. A feature of each machine is tape control for numerically controlled production. Included are heavy duty and planer type turret drilling machines, planer-type vertical drilling machine, and quill-type machine. Lahr Machine & Tool Corp., 3400 Maplewood Ave., Toledo 10.

16. New Pricing On Cylinders. Lower base prices on small to medium bore hydraulic cylinders and other price adjustments on air and hydraulic cylinders and boosters are incorporated into the new Pricing Booklet issued by Miller Fluid Power Div., Flick-Reedy Corp., Bensenville, Ill.

17. Parts Marking Machines. Price list and details cover hand, motor driven and pneumatic machines, with and without electronic controls, for marking flat or round parts and products. The Acromark Co., 15 Morrell St., Elizabeth 4, N.J.

18. Two-Way Relieving Fixture. Flyer describes the Hybco Model 2100-A with swivel index base and Hybco Model

(See Number 10)



(See Number 11)

(See Number 12)

2100-B with outboard bearing and tailstock. Fixture will produce variable radial and axial relief singly or in combination. Grinds circular type tools. Henry P. Boggis Co., 706 E. 163rd St., Cleveland 10.

19. Vertical Band Sawing Machine. The Band Mill, largest of the Contour-matic machines produced by DoAll, is specifically designed for band machining heavy, large workpieces with a 2" Demon high-speed steel saw band. It has a 26" throat, 24" work height, and 52" x 44½" worktable, with 48" usable travel, and is powered with a 10-hp variable-speed drive. Literature shows applications, features, and specifications. The DoAll Co., Des Plaines, Ill.

20. Height Master Gages. Booklet illustrates and describes the complete line of Pla-Chek gages. Included is data on the 6", 12", 18", 24", 36", and 48" models with the Thread Analyzer and Super Chek also described. Cadillac Gage Co., P.O. Box 3806, Detroit 5.

21. Milling Equipment. Bulletin VM-60 tells all about three sizes of portable Dumore Versa-Mil equipment for milling, drilling, slotting, boring, shaping, grinding and related machining operations on small, medium or large work. The Dumore Co., 1300 17th St., Racine, Wis.

22. Coolants and Cutting Fluids. Brochure No. 460B is an engineering handbook on coolants and cutting fluids used in machining, grinding, drilling, and many other metal cutting operations. It shows how high cost factors in every machining or grinding operation are affected by cutting fluid or coolant used. Featured is the firm's new chemical cutting fluid, Trim. Master Chemical Corp., 13 North Huron St., Toledo 1, Ohio.

23. Heavy Duty Lathe. Complete features, engineering data and specifications are provided on the Model HD 2013, third to be announced in the new Nebel line of proven design heavy duty lathes. Bulletin No. 212 from Nebel Machine Tool Corp., 3428 Central Parkway, Cinci. 25.

24. Contouring Lathe. Increased emphasis on machining larger diameter (18" to 36") workpieces requiring close tolerances, fine finishes has shown need for contouring lathe equipped with universal constant cutting speed (without speed control cams) over a wide diameter range. Operating principles, specifications, and special features are provided on the Powerturn 45° Copymatic, with new universal constant surface cutting speed control in literature from Lodge & Shipley Co., 3055 Colerain Ave., Cinci. 25.

25. Broaches and Broaching Fixtures. "Cut Broaching Costs With Red Ring Tools and Fixtures" is title of 12-page catalog which discusses the seven factors essential in a broaching tool. Described is a wide variety of high speed steel and carbide broaches for holes, splines, irregular surfaces, flat surfaces, keyways, and serrations. National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich.

(See Number 20)

(See Number 21)

(See Number 22)

26. Collapsible Taps. Revised Bulletin G-94-2 contains detailed information pertaining to the design and operating features of the Style ALT tap. Either revolving or stationary, the taps feature detachable head. This revised brochure incorporates two more head sizes adaptable to the 3 ALT tap body. Landis Machine Co., Waynesboro, Pa.

27. Optical Projection. J & L's 20-page publication "Quality Pre-Control" outlines the simplified quality control technique not only for use with the optical comparator but for other types of gaging. A mercury arc illuminating system is a replacement package adaptable to all J & L comparator models except their 7" bench machines. Jones & Lamson Machine Co., Springfield, Vt.

28. Pre-Honed Inserts. Pre-honed Carboloy cemented carbide inserts are described in "How to Get Better Profits Through Better Tooling." Pre-honing is said to make it possible to use grades of carbide that are harder and more wear resistant in operations where previously they would not be applied. Predictable tool life is increased. Metallurgical Products Dept., General Electric, Detroit 32.

29. Plain Horizontal Milling Machine, Model 00, is a complete machine with coolant system and instantly reversible power feed. Literature provides specifications as follows: Longitudinal power or hand feed, 26" or 32", depending on table size; transverse hand feed, 10"; vertical hand feed, 16"; center of spindle to overarm, 5⅞"; largest cutter accommodated, 11½"; eight speed changes from 50 to 1000 rpm, and table working surfaces, 40" x 9" or 46" x 9". Index Machine Co., 543 N. Mechanic St., Jackson, Mich.

30. "Make Your Own Signs" is title of folder illustrating signs made of Acrocel porcelain copper. The letters and figures may be assembled for any desired use, as required. The Acromark Co., 15 Morrell St., Elizabeth 4, N.J.

31. Quick Change Tools. These tools comprise quick change holders for milling machines, radial drills, boring machines, and lathes; quick change adaptors for drill chucks, taper shank tools, milling machine cutters; quick change boring tools and arbors; milling cutters, and accessories. Dimensions, diagrams, and applications are clearly provided to aid customer in ordering. Catalog No. 57 from Beaver Tool and Engineering Corp., Box 429, Royal Oak, Mich.

32. Metal Cutting Band Saw, Powermatic Model 87 20", is described in Bulletin No. 75. The Quick-Set speed selector is featured—accurately dials any speed from 40 to 4600 sfm. Advantage of automatic power feed. Powermatic Machine Co., McMinnville, Tenn.

33. Rectangular Steel Gage Blocks, as described in brochure, are available in all standard set sizes and accuracy grades to fit all requirements; also special sets

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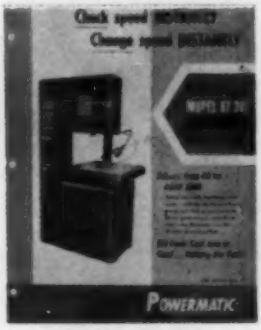

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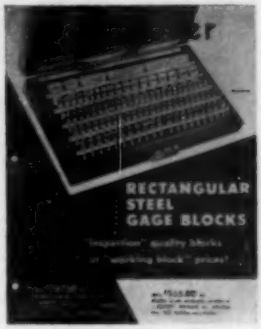

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for special needs. Webber has classified its two rectangular steel block grades as A+ and AA because accuracies exceed U.S. Bureau of Standards specifications. Price list included. Webber Gage Co., 12900 Triskett Rd., Cleveland 11.

34. Diamond Wheels. Comprehensive Catalog M1501 describes the complete line of Manhattan diamond wheels, with a complete net price supplement enclosed. Included is detailed data on available grit sizes and diamond concentrations, wheel markings, suggestions to prolong wheel service life, and complete ordering information on both resinoid bonded and new metal bonded diamond wheels manufactured by Manhattan. Abrasive Wheel Dept., Manhattan Rubber Div., Raybestos-Manhattan, Inc., Passaic, N.J.

35. Autocollimator. Bulletin 205-60 gives applications, product features, specifications, and a description of the instrument's method of operation. This new autocollimator for precision measurement of angular position and small linear displacements has recently been introduced.

Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14.

36. New Kennametal Cutting Grade. Nine high-velocity machining applications of Kendex throwaway inserts made of Kentanium Grade K165 are tabulated with brief records of their comparative performance advantages by Kennametal Inc., Latrobe, Pa., in a new two-page bulletin.

37. Vertical Milling Machine. The Rockford vertical mill incorporates a revolutionary drive with infinitely variable speed, a rigidly-held rotating head, a vibration-free quill, positive automatic depth control, and other advanced-design features. Other advantages and specifications are included in literature offered by Fenlind Engineering Co., 5602 Pike Rd., Rockford, Ill.

38. Plug Gages. Tables of dimensions and prices are provided for reversible steel, taperlock A.D.G., Trilock A.D.G. and tungsten carbide plug gages, as well as gage blanks and gage handles. Ten-page catalog from Dundick Tool Works, Inc., 3410 W. 31st, Chicago 23.

39. Flexible Shaft Machines. Catalog No. C-500 describes these single speed direct drive machines, with 1/3 hp to 3 hp motors, 1725 or 3450 rpms, in various models. N. A. Strand Flexible Shaft, Inc., 601 S. Washtenaw Ave., Chicago 12.

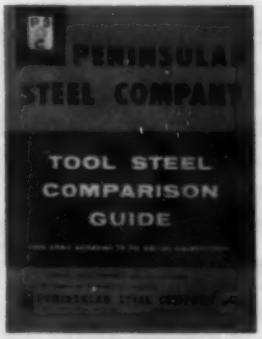
40. The Machine Tool Exposition—1960. Booklet answers questions about the Exposition. In addition to descriptions of why, what, and where, hotels and motels in Chicago and suburbs are listed (with price ranges normally charged). A tear-out Inquiry Time Saver Plate application form and form for obtaining Rapid Registration Card included. National Machine Tool Builders' Assn., 2139 Wisconsin Ave., N.W., Washington 7, D.C.

41. Tool Steel Comparison Guide. In this 28-page guide tool steels are listed according to AISI-SAE classifications. Included is a handy index reference, listing tool steels by trade name, classification and number. Peninsular Steel Co., 24401 Groesbeck Hwy., P.O. Box 3853, Detroit 5.

42. Radial Drilling Machine incorporates a table for small work, and platform for large work. Ranges of the models offered include 2½' arm, 53" opening, 18" deep holes, 60 to 3000 rpm, and 1⅛" drill in steel. Illustrations, advantages and specifications are provided in folder from I. O. Johansson Co., 7248 St. Louis, Skokie, Ill.

43. Automatic Cut-Off Machines that cut-off, chamfer, groove and form tubing and bar stock in a single fast operation are presented in recent catalog. It gives production rates for cutting solid bar stock and tubing. Machines cut bar stock up to 3" O.D. and tubing up to 8" dia. Modern Machine Tool Co., Jackson, Mich.

(See Number 40)



(See Number 41)

(See Number 42)

Complete your shop with this modern metallizing installation

WIRE GUN—Sprays any metal that can be drawn into wire form.

POWDER GUN—Sprays hard-facing alloys and ceramics in powder form.

Without metallizing, no maintenance or "job" shop can offer the same complete service as the shop that uses industry's low-cost "putting-on" tool.

With modern, low-cost metallizing equipment you can spray carbon steels, stainless, babbitts, brass, bronze, nickel, aluminum, tin, zinc, special hard-facing alloys, including tungsten carbide.

■ **Save up to 90% of replacement costs on machine repair jobs** ■ **Do your own hard-facing at high speed, low cost** ■ **Apply long-wearing, corrosion-resistant coatings**

A real opportunity for the smaller shop. Thousands of large, well-known companies and shops have been metallizing users for many years, not only in maintenance work but in production applications on original equipment. Now, with modern low-cost metallizing equipment this high-speed "putting-on" tool is within the reach of even the smallest shop.

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12 news of the industry

Norton Co.'s new Plant 8—focal point of their 75th Anniversary festivities.

NORTON CO. 75TH ANNIVERSARY CELEBRATED BY OPENING $6½ MILLION PLANT

A new $6½ million plant for the manufacture of organic bonded grinding wheels was unveiled on May 4 as Norton Co., Worcester, Mass., abrasive products maker, opened a two-week celebration of its 75th anniversary at a special program for editors of daily newspapers and publications. Plant No. 8 was built to provide additional capacity for the making of resinoid, rubber and shellac bonded grinding wheels.

Norton Co. actually began business on June 20, 1885, with the incorporation of the Norton Emery Wheel Co. There were seven founders including **Milton P. Higgins**, first Norton president, and **John Jeppson**, first

General view of the stock area of the new plant. In all, the company has 26 miles of shelves holding six million grinding wheels.

superintendent, whose descendants hold key positions with Norton Co. today. **Milton P. Higgins,** grandson of his namesake, is present company president, and **George N. Jeppson,** son of **John Jeppson,** the founder, is chairman of the board of directors.

From simple beginning in 1885, the company now has become a world-wide enterprise with many divisions and 24 plants, including 18 in foreign countries. With a nucleus of 12 men in 1886, the firm now employs a total of 14,000. The first building of 48' x 120' has expanded to a 1½ mile long plant, consisting of 124 buildings on 440 acres, and containing more than 3,500,000 sq. ft. of manufacturing space. Norton now offers 200,000 varieties of grinding and cutting wheels, and 20,000 stock items covering 26 miles of shelves.

There are other products besides the grinding wheels. To name just a few, we mention electro-chemical and refractory products, grinding and lapping machines, abrasive non-slip floor surfacing, gear cutting machines and shapers, sharpening stones, and many ceramic products for the Missile Age.

Through the years there have been many "firsts" for Norton. We bring you up to date with the 1960 historical milestones—development of man-made diamonds in the Norton laboratory, 75 Alundum abrasive for the grinding of stainless steel billets and slabs, and Minigrind mounted wheels for grinding miniature bearings and other extremely small diameters.

Norton Co. has kept pace with modern demands and has lived up to its 75th Anniversary slogan, "Seventy-Five Years of Progress Through Service to Industry."

Flick-Reedy Is Named One of Top Ten Plants

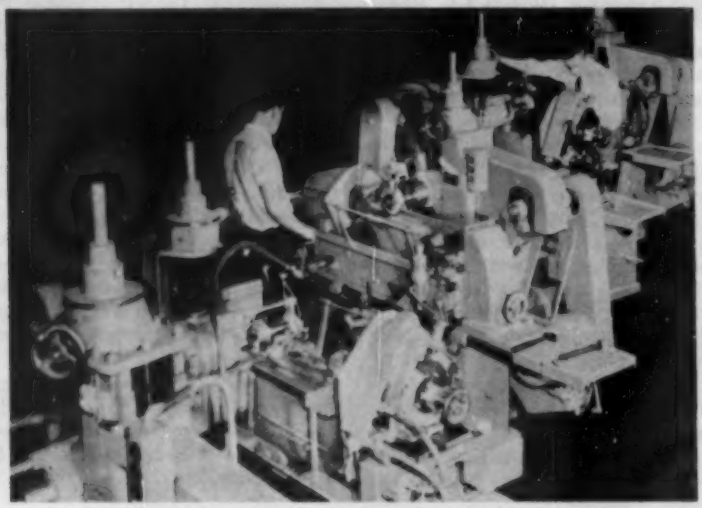
The Flick-Reedy Corp. of Bensenville, Ill., has been named one of the Top Ten Plants built in 1959. The plant was picked from over 500 nationwide entries by Factory, McGraw-Hill publication, in its 26th annual "Top Plants" competition. The citation reads: "With imaginative boldness, Flick-Reedy blended nine pre-engineered buildings into a deluxe production unit. A showcase of truly impressive facilities, the plant challenges the conventional—from its ingenious water collection system to its posh indoor swimming pool that serves as a fire reservoir."

Ex-Cell-O Acquires Magna-Sine

Ex-Cell-O Corp. of Detroit has purchased the sine plate business of the **Omer E. Robbins Co.** The newly acquired products include a line of Magna-Sine magnetic sine plates or chucks as well as non-magnetic sine plates used for inspection work.

Production and sale of these sine plates are to be handled at Ex-Cell-O's Greenville, Ohio plant under the Magna-Sine trade name. **Russell P. Scholl,** sales manager of Bryant gage products at Greenville, will be in charge of Magna-Sine sales.

Michigan Tool Launches Another New Division



One of several batteries of internal and external contour form grinders transferred to its new Enterprise Division by the Gear Grinding Division of Michigan Tool Co.

A new division providing complete facilities for production of highest quality spur, helical and bevel gears and splines for use in prototypes and in developmental quantities has been announced by **Michigan Tool Co.**, Detroit. The new Enterprise Division has been formed by combining a number of previous facilities with newly acquired facilities of the former **Enterprise Gear and Tool Corp.**

"We had recognized for some time a gap in our services to industry in connection with gears—the need for prototype or pilot-type production—between the laboratory development stage and the actual production stage by the customer," stated **Marvin Anderson**, president of Michigan Tool, in announcing the new division. "Our first step was to create extensive laboratory facilities," he added.

Key personnel in both manufacturing and sales at Enterprise have joined Michigan Tool, with headquarters at the main plant at 7171 E. McNichols Rd.

Nash Co. Buys Peerless Machine Co.

The **J. M. Nash Co.** of Milwaukee and Oshkosh, Wis. has acquired the **Peerless Machine Co.** of Racine, Wis., from the estate of **C. O. Wanvig** and **Chester O. Wanvig, Jr.**, president of **Globe-Union Co.**, Milwaukee. Peerless, a manufacturer of metal sawing machines, will operate as a wholly owned subsidiary of Nash.

New officers of Peerless Machine Co. are: **Herman Jongebloed**, chairman of the board; **Curtis Meyer**, president; **Norman J. Fischer**, executive vice president; **Frank Norris**, treasurer, and **Richard McGinn**, secretary. Peerless will continue its operation in Racine and will retain all its present employees.

Inquiry Time Saver System To Aid Visitors In Obtaining Literature at The Machine Tool Exposition—1960

Two time-saving features for the convenience of visitors have been devised for The Machine Tool Exposition —1960, to be held Sept. 6-16, in the International Amphitheatre in Chicago.

The first time saver has to do with registration. Registration consists merely of turning in the Rapid Registration Card, properly filled out in advance, together with the $3 registration fee. These cards are available from machine tool builders, salesmen for machine tool builders and distributors, magazines, and the Association itself.

The other time saver is the Inquiry Time Saver plate. This system makes it easy for the visitor to request information or literature from the exhibitor. The visitor merely hands his plate to the exhibitor, who will have an imprinting machine in his booth. An attendant then imprints plate on an inquiry form, with notation as to request.

Request cards for Inquiry Time Saver plates must be received before August 8. The cards are being distributed in advance by salesmen of machine tool builders and distributors. A card can also be obtained from National Machine Tool Builders' Association, 2139 Wisconsin Ave., N.W., Washington 7, D.C. The application card must be signed by the person to whom the plate is issued.

Second Int'l Coliseum Machinery Show in Chicago, Sept. 7-15

"Second International Coliseum Machinery Show" is the amplified title recently given the extensive exhibit set for Sept. 7-15, in Chicago. **A. Byron Perkins**, president, says the new terminology was prompted by the large number of imported machines recently added to the Coliseum display. Among these are machines and equipment fabricated and assembled in major plants of Italy, France, West Germany, Belgium, England, Japan and Canada. The equipment from abroad will compete for attention with the best in American machinery.

Perkins expresses confidence the show will attract a large portion of the 100,000 users of plant machinery expected in Chicago. He forecasts the Windy City will be crowded with plant operators and machinery users as three widely different shows will be operating at the same time.

More exhibits can be added to the display, Perkins says, for several choice locations remain. He expects to assign these in the next few weeks at his new offices, 2216 South Hill St., Los Angeles 7, California.

As the show's theme is "Profits through Machine Application," Perkins advises plant heads to insist that their key men attend.

Attendance is being encouraged by distribution of thousands of special invitations, obtainable from exhibitors or by direct application to Perkins' office.

Industry Estimate of Cutting Type Machine Tools

Shipments of cutting type machine tools in April totalled $44,300,000, which brings the total figure for the first third of 1960 up to $172,100,000. This is at a yearly rate of $516,300,000, as compared to shipments of $413,050,000 for 1959.

Net new orders of cutting type slipped to $36,750,000 in April. However, since evidence is given of constant improvement since the third quarter of 1958, it is felt this monthly drop is not too significant.

Shipments of metal forming type machine tools totalled $11,050,000 in April, bringing the first four months of 1960 up to $46,100,000. This gives a yearly average of $184,400,000 as compared to 1959 shipments of $125,100,000. Net new orders of forming type advanced to $14,900,000 which is the second best month since December 1956.

Figures are based on reports submitted to the National Machine Tool Builders' Association, Washington, D.C.

Skinner Acquires Horton Chuck Line

Paul K. Rogers, Jr., president of **The Skinner Chuck Co.**, New Britain, Conn., has announced Skinner's acquisition of the Horton chuck line from the **Geometric-Horton Div., United-Greenfield Corp.**, New Haven, Conn. Chucks will be manufactured at New

"That's the sand blast room, Mr. Helfrick.—Where did you go?"

Haven. Skinner will employ most of Horton's engineers and factory supervisory personnel.

The transaction includes the purchase of chuck trade names and trademarks, machinery, jigs, fixtures, inventory, drawings and patents of the Horton chuck line. A major part of the Horton line includes large-size chucks up to 60", and a line of electric chucks, types and sizes not manufactured by Skinner.

Carl Hirschmann's New Agents For High Precision Mach. Tools

The **Carl Hirschmann Co. Inc.**, of 30 Park Ave., Manhasset, L.I., N.Y., announces the following agents for their complete line of high precision machine tools:

Fuchs Machinery Co., 2401 N. 11th St., Omaha; **Haman Machinery Co.**, 1823 Walnut St., Kansas City, Mo.; **Louisville Machinery Co.**, 212 Eiler Ave., Louisville, Ky.; **Clair L. Martin Machinery Co.**, 286 W. 40th St., Indianapolis; **Cascade Tool Sales Co.**, 1405 S.W. 14th Ave., Portland, Ore.; **Dawson Machinery Co.**, 5700 1st Ave., Seattle, and **Capital City Steel Co.**, 324 W. 8th St., Salt Lake City.

Steptool Corp. Announces New Representatives

Steptool Corp. of Los Angeles announces the following recently-appointed representatives, with territories:

R. J. R. Kelley Co., 519 Main St., E. Orange, N.J. (N.H., Me., Vt., Mass., R.I., Conn., N.Y., N.J., Pa., Md., Del., and Washington, D.C.); **Hazerodt Associates**, 903 S. Woodward Ave., Royal Oak, Mich. (Mich., Ohio, W.Va., Ky., and Ind.), and **C. M. Huss Co.**, 2822 W. Peterson, Chicago 45, Ill. (Northern Ill. below Springfield, Decatur and Danville, and including these towns also, and Ia., and Wis.)

Heald Machine Elects L. H. Cousineau President

Lawrence H. Cousineau has been elected president of The Heald Machine Co., Worcester, Mass., at a recent meeting of the Board of Directors. He succeeds **Carles F. Roby** who recently retired as president of Heald. Mr. Cousineau has been associated with the company for the past fourteen years.

Re-elected company officers and directors were **Richard A. Heald**, chairman of the board; **Edwin J. Keyes**, vice president and works manager; **Raymond A. St. John**, vice president and general sales manager; **A. Francis Townsend**, vice president, engineering and development. **John A. Steen** was re-elected secretary and treasurer, and **Clayton F. Jones**, assistant secretary, assistant treasurer. **Frederick V. Geier, Jr.**, of Cincinnati, was re-elected a director of Heald.

In addition, two new directors were elected: **Hartwell G. Howe**, vice president and general manager and **Alfred T. Blackburn**, vice president, manufacturing, of Cincinnati Milling Machine Company, Cincinnati.

L. H. Cousineau

G. N. Popham

Popham and Associates Buy Gorham Tool Co.

George N. Popham and associates announced acquisition of Gorham Tool Co., Detroit.

Popham, president of Gorham for the past five years and spokesman of the new owner group, stated that all present management, supervisory and production personnel will be retained intact.

In addition to Popham, who will continue to serve as president and treasurer, other Gorham officers are **John J. Iglodan,** executive vice president and secretary, and **James L. Prisk,** vice president-manufacturing.

The company's general offices and manufacturing plant are located at 14401 Woodrow Wilson, Detroit 3, Mich.

ASTME Elects President And New Officers

H. Dale Long, president and chairman of the board, Scully Jones and Co., Chicago, has been elected president of the American Society of Tool and Manufacturing Engineers. Mr. Long has been with Scully Jones since 1940. He has been active in ASTME since 1943, holding various offices in the Chicago Chapter and the national organization. He succeeds **Wayne Ewing,** president, Arrowsmith Tool and Die Co., Los Angeles, as president for 1960-61.

Other officers elected to serve the 41,000 member organization for 1960-61 are: **William Moreland,** vice president, F. E. Myers & Bro. Co., Ashland, Ohio, first vice president; **David A. Schrom,** works manager, York Div., Borg-Warner Corp., York, Pa., second vice president, and **Philip R. Marsilius,** vice president, Producto Machine Co., Bridgeport, Conn., third vice president. **Frank F. Ford,** president, Ford Supply Co., Atlanta, Ga., was elected fourth vice president; **H. Verne Loeppert,** vice president, Boyd Wagner Co., Chicago, treasurer, and **Francis J. Sehn,** president, Press Automation Systems, Inc., Warren, Mich., secretary. Three new directors were also elected to the board.

The new officers were installed at the Society's Annual Banquet at the Statler-Hilton Hotel in Detroit, April 27. The banquet was held during the ASTME 1960 Engineering Conference and Exhibit in the Motor City, April 21 to 28.

Appointments and Promotions

Personnel Changes . . . Sales and Service

H. G. Howe

C. H. Munsey

J. A. Novak

E. W. Sundberg

Hartwell G. Howe, previously domestic sales manager, has been appointed vice president and general manager by the Heald Machine Co., Worcester, Mass. He succeeds **Carl M. Beach** who is relinquishing his duties for health reasons and will return to the Cincinnati Milling Machine Co., the parent company. **Glenn C. Moore,** export sales manager, assumes Mr. Howe's duties as domestic sales manager. **Charles H. Munsey,** formerly general manager of Heald Ltd., Birmingham, England, will take over from Mr. Moore as export sales manager . . . Verson Allsteel Press Co., Chicago, has named **Melvin D. Verson** to the post of president and chief operating officer for the company and **Jack Novak,** executive vice president, to the additional post of secretary. **David C. Verson,** chairman of the board, will function as chief executive officer . . . **A. S. Burgoyne,** previously vice president of manufacturing, has been appointed vice president and manager of the E. W. Bliss Co.'s Press and Die Supply Divisions. **Einar W. Sundberg** is now treasurer of the Canton, Ohio, firm. He was formerly vice president, secretary and treasurer of the Gamewell Co., a Bliss subsidiary. **W. H. Garrison,** formerly treasurer, who is retiring next year, was named assistant treasurer and assistant secretary . . . **Elwood Hemlin,** factory manager of R-O Manufacturing Co., is the newly elected vice president of the company. The firm recently moved into its new plant on Stephenson Highway in Madison Heights, Mich. . . . At the meeting of the board of directors of the Mid-West Abrasive Co., Owosso, Mich., **Arthur C. Reppenhagen, Jr.,** sales manager, and **Harlow G. Jones,** director of research and product development, were elected vice presidents. **Donald P. Wietzke,** auditor, was elected assistant secretary. **A. C. Reppenhagen, Sr.,** was re-elected president and treasurer of the company. **Daniel Wardlaw, C. W. Vekovius, R. A. McElhinney,** and **S. P. Jones** were re-elected vice presidents. **L. W. Corbett** continues to serve the company as

G. C. Moore

M. D. Verson

A. S. Burgoyne

E. Hemlin

secretary and assistant treasurer . . . **John R. Bartizal** has been elected president of the Clearing Div., U.S. Industries, Inc., New York City. Previously associated with the firm for ten years, he returns to Clearing after an absence of about six years . . . Cleco Air Tools, a division of the Reed Roller Bit Co., has made the following key promotions in its Houston headquarters plant: **M. D. Hoza** is now in charge of Research and Development; **G. A. Boyd,** Product and Project Engineering; **G. G. Walker,** Manager of Air Tools Services; **C. R. Gass,** factory manager, and **LeGard May,** personnel manager . . . **Ira R. Ogilvie** has been appointed advertising manager for the Merkle-Korff Gear Co., Chicago. He was formerly advertising manager with the George Gorton Machine Co., Racine, Wis. . . . **Walter E. Gregg** has been elected vice president—technology with Crucible Steel Co. of America, Pittsburgh. Formerly director of technology, he takes over a position vacated last October when **Maurice J. Day,** then vice president—technology, was named vice president—commercial.

Personnel Changes . . . Sales and Service

H. J. Bruck

F. J. Kenney

W. C. Heard

Henry J. Bruck, with the firm for 20 years, has been appointed manager of crankshaft and boring lathe sales for The R. K. LeBlond Machine Tool Co., Cincinnati . . . **Frank J. Kenney** has been named to the office of sales manager for The LaPointe Machine Tool Co., Hudson, Mass. . . . The Mid-West Abrasive Co., Owosso, Mich., announced that **Aubrey G. Rickards** is now field engineer for honing stone sales and service . . . **Desmond J. Hunter** has been appointed sales promotion manager for the Butterfield Div., Union Twist Drill Co., Derby Line, Vt. He will also have complete supervision of all New England and Upstate New York sales. **Gerald C. Staab,** headquartering in Pittsburgh, is the new sales engineer to cover western Pennsylvania for the Butterfield division . . . **Harry Mussun** was recently appointed director of Machine Tool Sales for The Kempsmith Machine Co., Milwaukee, Wis. . . . **William C. Heard,** formerly manager of domestic sales, has been elected to the post of vice president—sales for the Capewell Manufacturing Co., Hartford, Conn. In addition to supervising sales of Capewell saws, he will continue in his present responsibility of direction of the firm's national sales engineering staff.

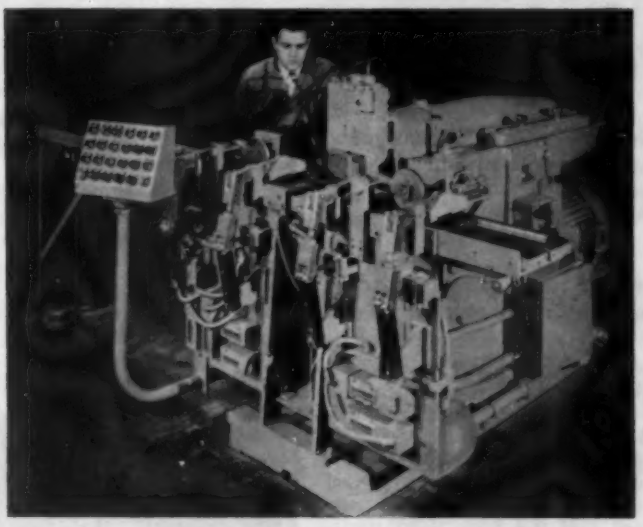
William J. Greene

William J. Greene, retired vice president and director of sales for The L. S. Starrett Co. of Athol, Mass., passed away on April 26, 1960, at his Shreveport, La. home.

Mr. Greene started work with the company in 1914 as a salesman in the New York office, and except for service in World War I as an aviation captain, devoted his entire career to the firm.

what's new in metalworking

13



Casing removed to show workings of hydraulic shaper.

SHAPER WITH FULL AUTOMATION

A new hydraulic shaper with full automation, believed to be the first of its kind, has been built and installed by Rockford Machine Tool Co., for conveyor line production of sleeve bearings.

With full automatic cycle, including loading and unloading, this Rockford automated shaper finish-machines one vertical and one angular surface on the edge of each of two steel plates simultaneously, prior to bending the plate into a circle and butt-welding to form the shell for a sleeve bearing. Machining is completed in 9 cutting strokes, utilizing a cutting speed of 40 ft./min. and 100 ft./min. return. Operator simply starts machine and it operates continuously until it is stopped.

The machine is equipped with two tool holders and tool gauges for presetting tools. Four standard high speed steel tool bits with identical grinds are used. The trailing edge

of one plate and the leading edge of the following plate are machined in the cutting sequence. When tools have reached the predetermined depth, the toolhead is raised automatically and pneumatic indexing against positive gauge-stops positions the next pair of plates for machining. At the same time one plate is loaded and another ejected to the conveyor line. No attention is required from the operator other than to change tools as required.

The engineers report that this automatic method of machining flat parts offers time and cost advantages over other machining methods, as well as saving the cost of cutting tools and fixtures.

This new machine is a standard Rockford Hy-Draulic 24" shaper, with a special crossrail and toolhead, and equipped for complete automatic cycling. Transfer and index are pneumatic against gauge stops; clamping, tool relief and tool positioning are hydraulically controlled.

The machine has built-in safety devices to protect operator and prevent damage to the machine.

Switches may also be used in manual position for independently operating either shaper or transfer mechanism for set-up purposes.

Rockford Machine Tool Co., Dept. 207, 2500 Kishwaukee St., Rockford, Ill.

Use postpaid card. Circle No. 56

Hydraulic Feed Surface Grinder

Micro inch finish at production speeds is a feature of a fully hydraulic No. 206 feed surface grinder.

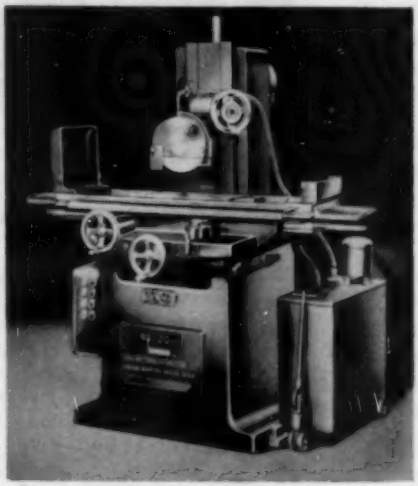
Built around a solid one-piece column and base, it assures permanent alignment between vertical head ways and cross travel ways, a traditional Grand Rapids feature. Amount of cross feed is controlled from a panel on saddle front and the cross feed itself is variable up to ¼" per table reversal.

This new machine is equipped with a Vickers vane type pump and a Gallmeyer & Livingston-designed control valve — giving an infinite number of longitudinal table speeds up to 110' per minute. Also provided is a variable speed continuous cross feed for dressing or quick positioning. Saddle may be automatically reversed at any pre-determined point by adjustable dogs mounted on side of base.

The vertical movement of wheel head is made by a large (outer) hand wheel and/or a small (inner) one, conveniently located on the head of the grinder.

Severe service demanded by the use of diamond wheels is no problem with this machine since it has a rugged, four-bearing grease-sealed spindle. Spindle requires no lubrication for the life of the bearings.

The new grinder is regularly equipped with an 8" grinding wheel,

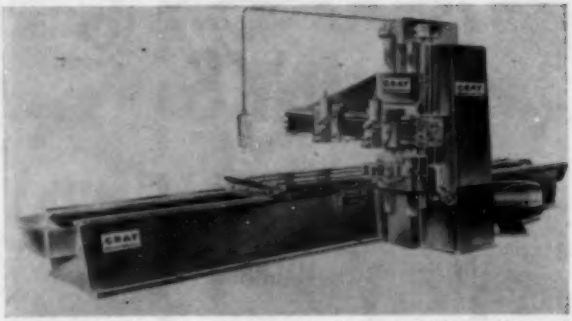


with 13" capacity under the wheel and 14" of vertical movement.

Gallmeyer & Livingston Co., 430 Straight Ave S.W., Grand Rapids 2, Mich.

Use postpaid card. Circle No. 57

Small, Rugged Planer Uses Carbide Tooling



Planer is available in nine combinations of table widths and heights—basic sizes are 30", 36", 42".

The Gray Flying Scot is available in nine combinations of table widths and heights—basic sizes are 30", 36", 42". It features rugged components engineered to resist torsional deflection and vibration under the heaviest of cuts in either direction. The wide face on the column, the rail, and the rail heads are all square locked, which rigidly resists the forward and reverse thrusts produced in double cutting.

The new Helicone transmission is a simple drive, is self-contained, and provides a non-pulsating motion to the table on long as well as short strokes. The manufacturer states it is therefore ideal for carbide planing.

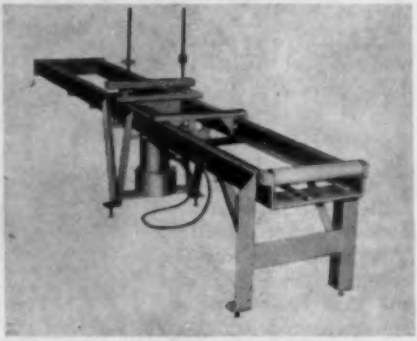
The constant torque motor (60/75 hp) is adjusted, by rheostats, both in the cut and return direction, from 180 to 1,800 rpm. The standard planer ratio furnished is six to one, which provides table speeds from 30′ to 300′ per minute.

The planer is available with single or double cutting heads, or any combination of both.

The G. A. Gray Co., Dept. D-202, Cincinnati 7.

Use postpaid card. Circle No. 58

Automatic Bar Feed Unit Is Easily Set Up



A new heavy-duty automatic bar feed unit has been designed for use on W. F. Wells' Models W-9, F-14 and J-24 horizontal metal cutting band saws. Built with extra-heavy construction, the unit is self-contained with hydraulic drive. It can be set up in a few minutes to feed stock for duplicate cuts of identical length. It need not be removed for hand operation of the saw.

Designated the BFH-24, it will feed a 10' bar in automatic cycles with a maximum of 14" per cut without resetting. The new bar feed unit is 10' long, 2' wide. Bed height is adjustable from 25" to 26".

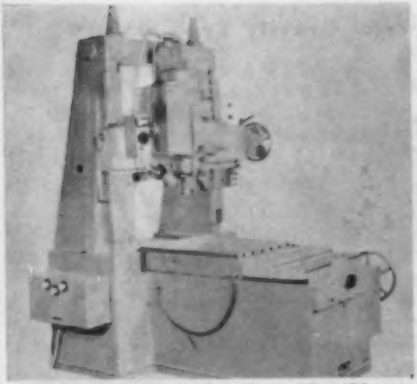
W. F. Wells & Sons, Inc., Three Rivers, Mich.

Use postpaid card. Circle No. 39

Improved Hauser Jig Borer

A new improved version of the Hauser No. 5 jig borer has been announced. The exceptionally rigid frame, consisting of machine base, columns and upper cross slide were basically adapted from the older model, as were the micrometer screws, the broad, hand scraped guide ways, and several other basic design features.

The new features include a 7,700 lb. weight as compared to a 6,600 lb. in the older model—accounting now for more rigidity. The spindle motor horsepower has been increased from 3 hp



Infinitely variable speeds from 10—430 rpm and from 50—2,000 rpm now offered.

to 4 hp. Additional table supports have been added. Power operated tool clamping is another advantage.

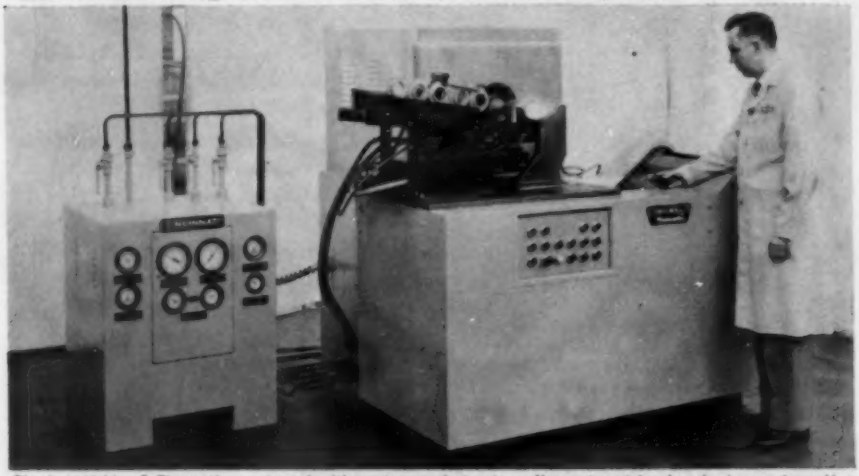
The new model now has infinitely variable speeds from 10 - 430 rpm and from 50 - 2,000 rpm.

It is reported that the new, additional knob for fine-setting the "last tenth" eliminates the problem of "tapping in the handwheel" for the fine adjustment and perhaps overshooting the correct setting.

Carl Hirschmann Co. Inc., 30 Park Ave., Manhasset, L.I., N.Y.

Use postpaid card. Circle No. 60

Flame Hardening Machine With Special Gravity Type Fixture



Cincinnati No. 3 Flamatic equipped with water cooled rotary flame head for hardening automotive stator hubs demonstrated at the American Society of Tool and Manufacturing Engineers Show, April 21 to 28, 1960. New compact, low cost gas control cabinet regulates fuel gas and oxygen including accommodations for air and water. (Meta-Dynamics Div., The Cincinnati Milling Machine Co., Cincinnati 9.)

The Cincinnati No. 3 Flamatic flame hardening machine illustrated features a special gravity type fixture. Automotive stator hub (3.94" O.D. and 2.157" I.D.) made of SAE 1062 steel has the inside bore flame hardened to 60-62RC with depth hardness of .125". Production 208 parts per 52 minute hour.

Part is fed by gravity down an inclined chute and located on cradle type fixture in front of the rotary flame head. The flame head advances into the part bore and rotates,

Close-up of new Cincinnati Flamatic equipped with water cooled rotating flame head.

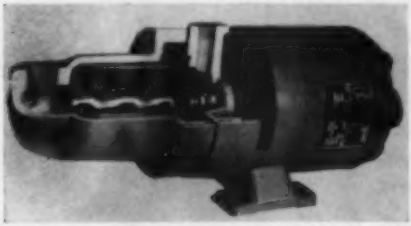
selectively heating the I.D. At the completion of the heating cycle, the flame head retracts, the cradle tips forward and the part is dropped into an integral quench tank. A conveyor carries the part out of quench tank.

Meta-Dynamics Div., The Cincinnati Milling Machine Co., Cincinnati 9.

Use postpaid card. Circle No. 61

Positive Displacement Coolant Pumps

The PresSure Kool pump, a positive displacement coolant pump, uses the Moyno principle in the form of a helical screw rotor turning in a stator to insure positive delivery of coolants



or cutting oils at any one or more constant pressures.

The pump's vibration-free positive displacement delivers clear, non-foaming coolant without constant manual control of coolant flow, the manufacturer writes. Pump drive starts automatically with the machine, but can be an integral part of, or separate from, the machine drive.

Products Div., Associated Engineers, Inc., P.O. Box 1628, Springfield, Mass.

Use postpaid card. Circle No. 62

Light Duty Mill's Hydraulic System Has Only Three Parts For Easy Service

A hydraulic feed milling machine is reported to feature foolproof and positive feed, and is designed for light duty production at low initial cost.

Model 624 Hydro-Mill has completely hydraulic feed with infinite table speed both directions from 0 to 600" per minute.

The hydraulic system has only three main parts for easy and quick service,

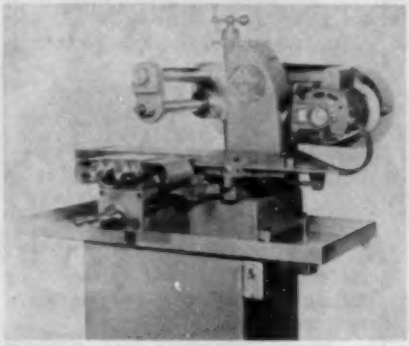


Table is 6" x 24", has 10" travel, 4½" transverse travel.

and provides changeover on feeds in less than a minute.

The feed may be set from right to left and rapid return, or from left to right and rapid return, or from right to left and stop then left to right and stop for use with two fixtures.

Other specifications include a 2⅞" rise and fall of spindle in any one setting with production handle; 6" rise and fall of spindle with lead screw; four spindle speeds ranging from 500 to 2050 rpm from ¾ h.p. motor; 7" maximum from table to center of spindle.

Northern Illinois Machinists, Crystal Lake Rd., McHenry, Ill.

Use postpaid card. Circle No. 63

Special Coil Cradles For Wire

The Medelton "Poweroll" coil cradle can easily and inexpensively be adapted to solve special handling problems.

Illustrated here are several cradles modified to uncoil spools of heavy wire for subsequent operations.

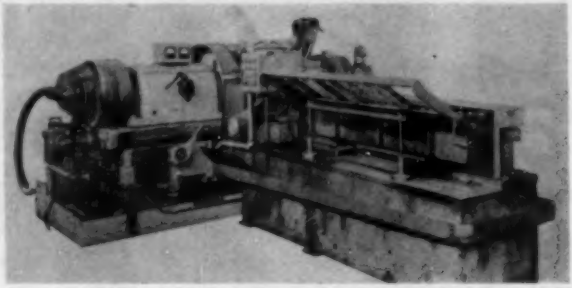
Coil cradles were selected for this application because they provide: ease of loading, slack loop for feeding, and ability to accommodate a wide range of spools without adjustment.

The Medelton Co. Inc., 262 East 3rd St., Mt. Vernon, N.Y.

Use postpaid card. Circle No. 64

Chain-Feed Double-Disc Grinder Features High Stock Removal

Rigidity, positive spindle feed, and 50 hp spindle drive motors are said to account for the grinder's ability to remove stock at practical limits governed primarily by thickness of piecepart and wheel economy. A feature of Mattison's new chain-feed mechanism is its "disappearing link" principle. This permits a variety of piecepart sizes to be fed into the machine without adjustment or change in the loading and feeding mechanism. Closely spaced drive links drop into neutral position when interference pressure from the piecepart is applied. Next free link drives the part, permitting feeding of various sized parts.



Removes .015" of 1045 steel in one pass, at a feed rate of 8' per minute.

On chain saw guides made of high-carbon steel, total stock removal of .015" is accomplished in a single pass at a feed rate of 8' per minute. Size is reported as held to .002" and parallelism, end to end or side to side, is held to .001".

A dial indicator tells the operator when wheel wear approaches size limits.

Grinder uses 30" cylinder wheels.

Mattison Machine Works, Rockford, Ill.

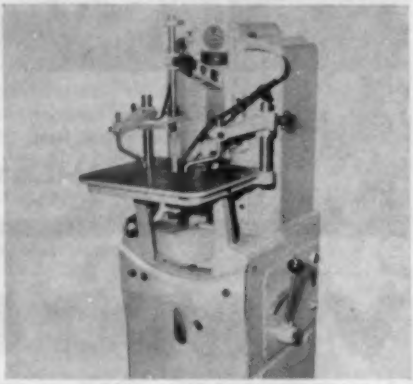
Use postpaid card. Circle No. 65

Filing and Sawing Machine

The THIEL 115 filing and sawing machine features infinitely variable speed and length of stroke, 9½" throat depth, and an 18" x 18" work table which tilts in four planes through 15°. Work hold-downs, magnifying glass, chip blower and lamp are provided.

Both compression and tension type files may be utilized on the machine, and files from .039 are available in all standard shapes. The machine is particularly suited for small internal work.

The machine may be set-up for



An 18" x 18" work table tilts in four planes.

machining of carbide or other hard steels. Rotary or stationary files with sintered diamond chips are employed as tools. Straight sawing of the hard materials is done with a round diamond file, rotating at 12,000 rpm while reciprocating up and down. Feed is accomplished manually or with a subtable equipped with counter weights.

United Machine Tool Co. of Calif., 3620 Santa Fe Ave., Los Angeles 58.

Use postpaid card. Circle No. 66

HSS Hacksaw Blades

The Silver Streak line featured by Atkins Borg-Warner is a companion to Atkins Silver Steel tungsten blades. Recent literature presents the following information:

Hand Hacksaw Blades—includes the Silver Streak flexible back high speed

hard edge blades, Silver Streak all hard high speed hacksaw blades, and Standard flexible back hard edge alloy steel blades. These all cut the common metals. Silver Steel tungsten high speed all hard blades cut hard, extra tough steels and highly abrasive materials. Furnished in Raker or Wave set, 10" or 12" long, ½" wide, .025" thick.

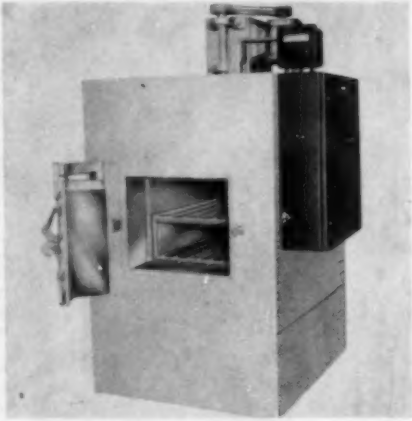
Power Blades—incorporate the Silver Streak solid HSS power blades, Silver Streak welded edge HSS power blades, both designed for general purpose cutting of ferrous and non-ferrous materials. The Silver Steel tungsten high speed power blades cut hard-to-machine materials, hard, tough steels with "work hardening" tendencies, and highly abrasive materials. Power blades are offered in 12" to 36" length, ⅝" to 4½" wide, and .032" to .125" thick.

Atkins Saw Div., Borg-Warner Corp., 402 S. Illinois, Indianapolis 25, Ind.

Use postpaid card. Circle No. 67

Tool Room Furnace For Many Heat Treatment Jobs

A new electric Whirlblast furnace has temperature range to 1350° F. Special convection heat flow design uses extremely high air velocity with extra air volume to give penetration to dense loads, very fast heat recovery, and extremely close work chamber uniformity, it is reported. The furnace is recommended for use with protective atmospheres, for aging and solution heat treatment of aluminum. Other



uses include: brass annealing, magnesium heat treating, tempering, etc.

It is stated that the excellent heat uniformity in the work chamber and precision controls make the furnace valuable for laboratory work and product control.

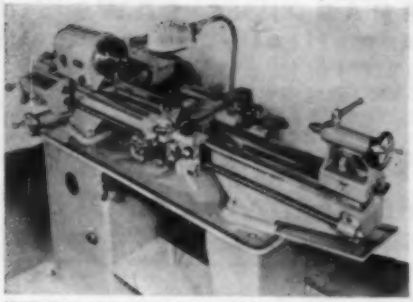
Sizes 18" x 24" x 18" to 42" x 72" x 42" inside work chamber measurements.

Despatch Oven Co., 619 S.E. 8th St., Minneapolis, Minn.

Use postpaid card. Circle No. 68

Long Bed 10" Metal Lathe

A new long bed model Delta 10" metal cutting lathe has a capacity of 36" between centers. The model also features the variable-speed drive, ¾" collet capacity and all other features



of Delta's standard 10" metal lathe introduced last year. The new lathe is designed to fill the need for a low-cost lathe to do heavy-duty work in commercial metalworking shops, plant maintenance shops, tool rooms and other industrial operations.

Two new safety accessories make the lathe particularly applicable for school shops. They are: a magnetic starter electrical disconnect switch kit which automatically shuts off the motor

when headstock cover is swung open; and a mechanical back gear lock-out kit which protects the gears of the headstock because it forces the operator to raise the headstock cover before the back gears can be engaged.

The variable-speed drive gives the operator all the advantages of infinitely variable speed from 50 to 1500 rpm, plus the high torque transmitting power of matched V-belts in the final drive to the spindle.

The ¾" collet capacity is obtained by using a 4-C style collet with a 15/16" hole through the spindle.

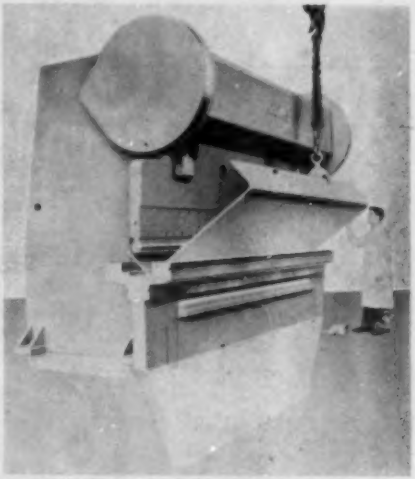
A quick change gear box provides a choice of 54 feeds or thread pitches.

The lathe is used with a full ¾ hp motor. Price, without bench, motor and switch, is $722.50, f.o.b. factory.

Rockwell Mfg. Co., Delta Power Tool Div., 471 N. Lexington Ave., Pittsburgh 8, Pa.

Use postpaid card. Circle No. 60

Niagara Press Brake Line Redesigned and Enlarged



Capacities—90 through 1500 tons.

New Series N Press Brake design features and expansion of tonnage ca-

pacities (now 90 through 1500) have been announced by Niagara Machine & Tool Works. Over-all bed and ram lengths range from 6' to 24', while bending capacities are for 12 gauge to 1" mild steel.

Principal among the design changes are: choice of power or manual clutch, brake and treadle; two-speed transmission; rocker type end guide bearings for precise, endwise alignment, even when the ram is tilted for taper work, and a wide choice of special features and arrangements to meet individual conditions.

Construction is of one-piece welded steel except in the larger sizes where the deep bed, extending below the floor, is removable. Both frame and bed are scientifically designed for utmost rigidity and longer die life, according to Niagara.

Niagara Machine & Tool Works, 637-687 Northland Ave., Buffalo 11, N.Y.

Use postpaid card. Circle No. 70

Hole Location Gage Has Quick Interchangeable Spindle

This hole location gage features a quickly interchangeable spindle for lasting economy. While the large, lightweight handle is rotated with the spindle on ball bearings, the indicator remains stationary. Other design features are said to assure accuracy and

repeat accuracy regardless of size of gage.

The gage is used to check hole location, concentricity, and alignment, or to explore a hole to see whether it is tapered, "out of round", or machined "out of square".

To show the operator, after gage is inserted, in which direction he is checking, a pin in the handle is placed in line with the contact point. Adjustable stop collar and norbide tip are optional.

Zero Internal Gage Co., 11360 Schaefer Highway, Detroit 27, Mich.

Use postpaid card. Circle No. 71

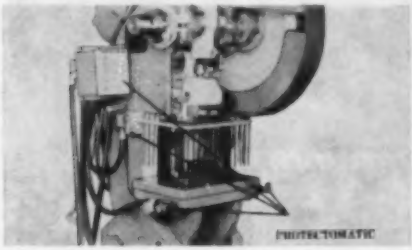
Safety For the Operator By Machinery Control

The Protectomatic Control is an automatic device that provides greater safety for the operator of power machinery by eliminating the possibility of accidental injury. Used to control the operation of punch presses, power shears, etc., the device permits operation by any one of five methods: (1) foot switch; (2) one hand non-automatic; (3) one hand automatic; (4) two hand non-automatic, and (5) two hand automatic.

Choice of operating method is

accomplished by turning a selector knob in the control box. To enforce safety precautions, the control box is equipped with a lock and key so method selection cannot be changed without the knowledge of a responsible person.

The device is easily added to existing equipment. Cost is $194.50 fob Minneapolis.

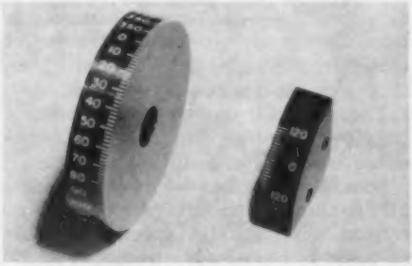


Protectomatic, Inc., 708-42nd Ave. N., Minneapolis 12, Minn.

Use postpaid card. Circle No. 72

Ultra Precision Engraved Drum Dials and Verniers

PIC Design Corp., a subsidiary of Benrus Watch Co., Inc., has announced a complete new line of ultra precision engraved drum dials and verniers. Available in four basic diameters—



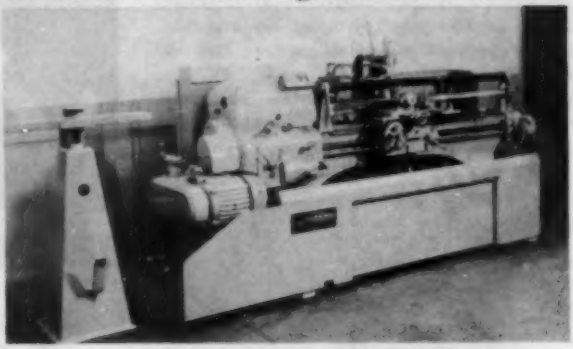
1½", 2", 2½" and 3"—these drum dials are made to Mil Specifications, black anodized with white filled engraving. They offer exact vernier reading within six seconds of a degree.

PIC Design Corp., 477 Atlantic Ave., East Rockaway, L.I., N.Y.

Use postpaid card. Circle No. 73

Tracer Controlled Centerless Contour Turning Machine

The Karge Turnomat Model 902 has the advantage of adjustable automatic carriage stops, four tool turret attachment, longitudinal feed stop, power cut-off, etc. Illustration points out the barstock stand at the left. Start-stop push button controls the main drive and on-off for the coolant pump.



Spindle speeds are variable from 800-2,500 rpm.

Specifications of the tracer type turning machine cover depth of cut, adjustable, .001"-.014" per revolution; spindle speeds variable from 800-2,500 rpm, and 5 hp electric VariaDrive motor.

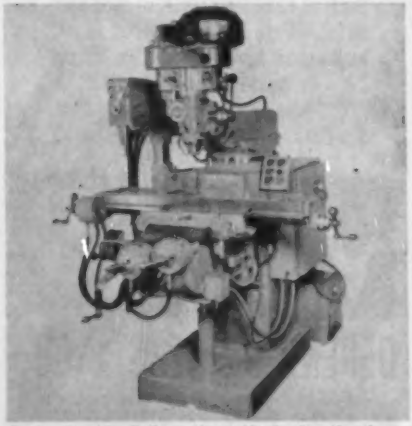
Capacities include round bars, .375"-1.750" diameter; hexagon bars, .375"-1.500" across flats, and finished part length, 40" maximum.

Taber Instrument Corp., 111 Goundry St., North Tonawanda, N.Y.

Use postpaid card. Circle No. 74

Hydraulic Tracer Control For Milling Machines

Tree Tool and Die Works has announced the addition of a hydraulic tracer control for its 2UVR and 2VG milling machines. The control, called the Scan-O-Matic, is manufactured in Racine by the Waterborg Machine Co. This control adds fully automatic hydraulic three-dimensional scanning and profiling to these milling machines.



Control adds fully automatic hydraulic three-dimensional scanning and profiling to milling machine.

In this system of three-dimensional duplication the stylus follows the contour of the model operating a dual valve which coordinates the knee and table or knee and saddle motions. Thus as either the table or saddle moves to scan the model a constant rate of cutter feed is maintained over any surface from horizontal to vertical.

The machine operates automatically for close tolerance duplication or semi-automatically for profiling.

Specifications for the two machines, 2UVR and 2VG models, are as follows, respectively: spindle speeds, variable 60-3,300 rpm and (12) geared 50-2,500 rpm; travel, 4" (hand or power) and 6" (hand or power); collet capacity, ¾" dia. shank and 1" dia. shank; spindle, 1½ hp and 3 hp, and table size, 10½" x 42" for both models.

Tree Tool and Die Works, 1600 Junction Ave., Racine, Wis.

Use postpaid card. Circle No. 75

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Industry's preferred localized lighting for 25 years, Localites are task-engineered to the particular job . . . are ruggedly built . . . cool to the touch . . . can be instantly positioned . . . stay put even under severe vibration!

Model R-39—"Durez" reflector mounted on flex-arm and stem.

Model 55-BH-701—Most popular unit . . . Kool-shield prevents burns.

Model 55-VCX-701—Vented reflector stays cool. Takes rough-service lamps.

• **Ideal for machine tool use, inspection and assembly lines • Most models U/L approved • Reduce fatigue . . . increase worker speed and accuracy • Easy to mount.**

Write for catalog. **Fosteria Corporation, Fostoria, Ohio**

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Will pay for itself in 60 to 90 days

On turrets, engine lathes, cutting-off machines, drill presses or any type of chucking machine, the Barker Two-Jaw or Three-Jaw hand operated chuck will increase production up to one third and actually pay for itself while doing it in from 60 to 90 days. Hand lever eliminates pneumatic and hydraulic systems, yet closes and locks jaws with lathe running or stopped. Over 30 years of labor saving, production boosting operation.

Hand lever closes and locks while lathe is running.

Jaws locked

Write for bulletin 201 today.

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THOMAS HOIST CO.
34 S. HOYNE • CHICAGO 12, ILL.

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USE IT EITHER WAY

Full 1/3 h.p. G. E. Motor

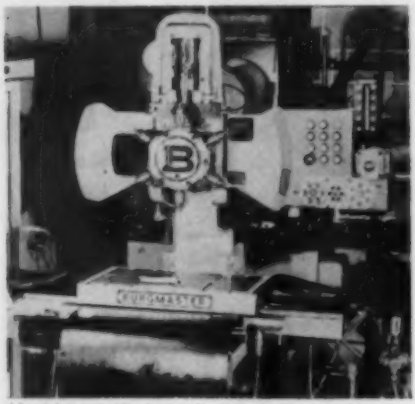
At last, a top quality industrial sander that provides all the most wanted features—yet sells for so little. $89.95
complete-with cord, plug, switch ready to use

Illustrated Literature on Request
A few desirable distributor territories still available.

WALLS SALES CORPORATION
333 Nassau Avenue Brooklyn 22, N. Y.

Use postpaid card. Circle No. 334

Automatic Turret Drills Double Speed Range Selection



Machine control panel shows new twin spindle speed-cycle control drums permitting instant selection of any one of 8 speeds for each spindle. Selection is simply made by turning knurled knob corresponding to each turret spindle to desired setting. No pick off gears are used and entire turret setting can be made in a few minutes.

Through the use of a four-speed motor, Burgmaster automatic turret drills offer a selection of eight individual speeds in any of four speed ranges per each spindle. The new design is available in both the Models 2BH and 3BH, respectively 6 and 8 spindle turret construction equipped with automatic hydraulic controls. The amplified speed range is also available in the companion tape controlled 6 and 8 spindle models.

The wider range of speed selections for each spindle facilitates operation at the most efficient machining speed—from slow spindle rpm's required for tapping and for large tools, to high rpm's best suited for small diameter high speed drilling and boring operations.

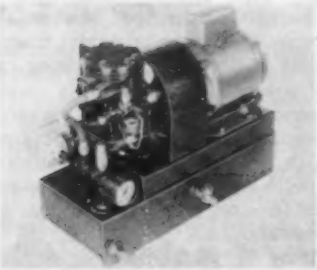
Burgmaster Tool Corp., Gardena, Calif.

Use postpaid card. Circle No. 76

Compact Air Compressor

A newly designed air compressor is said to offer compactness along with quieter and more durable heavy-duty operation. The first of a series of models, the new "automatic air plant" is rated at 1/3 hp. Dimensions are 18" long, 12" wide, 15" high. With 1/3 hp at 1725 rpm, this compressor has a piston displacement of 2.70 cfm, and operating range of 100 psi.

The compressor has forced feed oil pressure lubrication and a self-contained air cooling fan. Oil supply is



clearly visible and sealed against contamination.

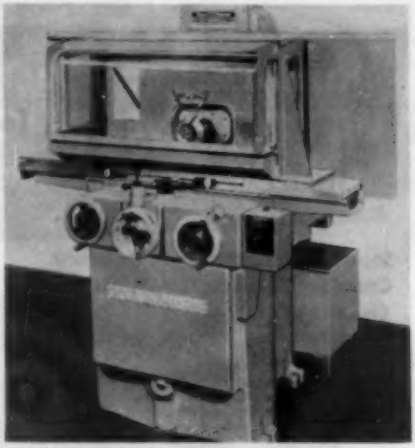
Leaf type exhaust valve eliminates need for a check valve. Direct coupling of pump and motor is said to assure positive power transmission with no slippage as in belted equipment.

Ajax-National Air Compressor Div., Ajax Equipment & Electric Co., 229 Centre St., N.Y. 13.

Use postpaid card. Circle No. 77

Slicing and Dicing Machine For Semi-Conductor Materials

Brown & Sharpe reports that its new 618 Micromaster® slicing and dicing machine automatically wafers semi-conductor materials such as germanium, silicon, quartz crystals, etc. with parallel accuracy to one ten-thousandth of an inch, and consistently repeats in size to plus or minus two ten-thousandths.



Utilizing a metal-bonded or resinoid-bonded diamond wheel, this easy-set-up machine produces clean, "burn-free" wafers. The manufacturer also states that the table driving mechanism provides smooth feed, infinitely adjustable from 0.100" to 144" per minute with rapid table positioning adjustable to approximately 25' per minute.

With the addition of a wheel sleeve and by ganging wheels, wafers can be diced in quantity with one pass of the table. Where only dicing is required, machines are available without automatic cross feed and indexing mechanism.

Unit construction permits optional arrangements to be built in easily.

Machine can be converted for conventional surface grinding.

Brown & Sharpe Mfg. Co., Machine Tool Div., Providence 1, R.I.

Use postpaid card. Circle No. 78

36 Gage Block Set Of Grade "A+" Quality

Appreciating the need of thousands of precision manufacturers for gaging sets which contain only the block sizes actually needed in their production, Webber has developed an entirely new set of blocks selected to meet the specific needs of these smaller shops.

Instead of the up to 92 blocks of the standard full size set, the new set contains 36 blocks, including two .100"

Croblox wear blocks. By "wringing" two or more blocks together a great

number of essential combinations can be obtained. Classified as Grade "A+" by Webber, they have the accuracy reported of +.000004" —.000002". The company points out that these accuracies exceed those specified by the U.S. Bureau of Standards for Grade "A" blocks.

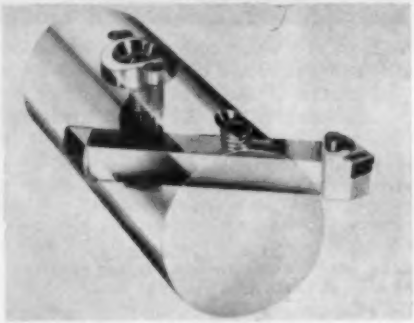
Packed in a plastic chest, sets are priced at $157.50 each.

Webber Gage Co., 12900 Triskett Rd., Cleveland 11, Ohio.

Use postpaid card. Circle No. 79

Throwaway Insert Cutters For Micrometer-Adjustable Tooling

New cutters with standard throwaway carbide inserts have been designed for use in micrometer-adjustable Super-Mike flycutter tooling manufactured by



Phantom drawing shows new Davis throwaway insert cutter mounted in Davis Super-Mike micrometer-adjustable flycutter bar.

Davis Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

Davis micrometer-adjustable flycutter assemblies are available in stub boring tool sets, stub and line bars, multiple-cutter boring heads, extension boring heads, and other types of Davis tooling. The new throwaway insert cutters are interchangeable with standard HSS or carbide Super-Mike cutters.

The cutter is adjustable in increments of .0001" by means of a direct-reading micrometer dial screw. It is reported that adjustment can be made without releasing setscrew pressure on the tool shank. This feature insures that the

cutter holds position without backlash and resulting loss of accuracy.

For rough boring, the new cutter can be accurately set with a gage and then dial-adjusted for semifinish and finish boring.

Use postpaid card. Circle No. 80

Tap Extensions For Pipe Taps

Tap extensions for pipe taps, the new addition to the line of Walton Style B tap extensions, fits pipe taps from 1/16" through ½". Made to close tolerances and carefully heat treated, these 8" extensions make possible either machine or hand tapping of those otherwise inaccessible holes.

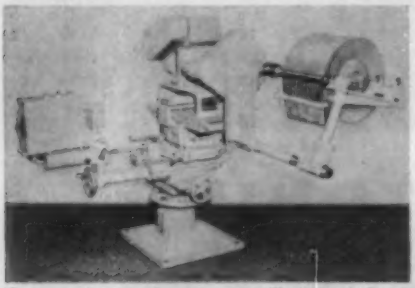
A new feature introduced with these pipe tap extensions, and soon to be incorporated in all Style B tap extensions, is that the socket set screws are placed 90° apart rather than 180° as previously placed, in order to give a better grip on the tap.

The Walton Co., Hartford 10, Conn.

Use postpaid card. Circle No. 81

Machine Automatically Finishes Parts Having Obstructions

A new Acme oscillating arm-type machine, equipped with an air cylinder advance, automatically buffs or polishes various parts which have obstructions



Two machines like the one illustrated finish ratchet-type wrench heads at a rate of 600 wrenches per hour with one operator.

preventing complete rotation. It buffs parts such as coffee pots with spouts or ratchet-type wrench heads with handles which prevent complete rotation of the part.

With parts positioned in the arm, they are advanced by an air cylinder control into contact with the buffing wheel. A pushbutton initiates a timed sequence of arm oscillation to give desired wheel contact time.

The oscillating arm unit can be adjusted to give from zero to 360° of oscillation for a variety of part finishing needs.

Acme Manufacturing Co., 1400 E. Nine Mile Rd., Detroit 20.

Use postpaid card. Circle No. 82

Two Free Handy Pocket-Size Slide Calculators

Two newly designed companion slide calculators are offered, without charge, for use in a wide variety of metalworking applications. The set consists of a Carb-A-Guide card, a Computer Slide card, and a protector-holder.

By simply sliding the arrow to the type of material to be machined, the

Carb-A-Guide will give the user machinability ratings, grade of carbide to be used, and surface speed for various ranges of feed and depth of cut.

The Computer Slide is a speedy multi-purpose calculator, incorporating technical data on hardness conversion, speed conversion, milling feed rates, and horsepower.

Adamas Carbide Corp., Kenilworth, New Jersey.

Use postpaid card. Circle No. 83

Improved Version of The Strippit Fabricator

The new Strippit fabricator, Model 15A, is designed for punching, notching and nibbling, particularly for prototype work, short or medium production runs. Featured is a new Electro-Hydramatic head, the part of the machine controlling the power stroke of the ram, and which eliminates the need for pressurized air required on earlier models. This elimination permits a

simplified control mechanism. Reducing the number of parts in the head makes the machine easier to install also.

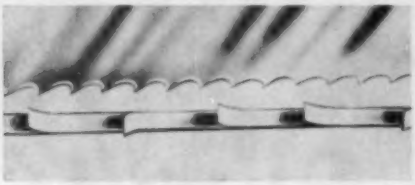
The fabricator punches round or shaped holes up to 3½" dia. in any sheet material (including printed circuit boards) up to ¼" mild steel. Its maximum notching capacity is 5" x 5" in ⅛" mild steel.

As with previous models, this one features multiple-stop, side and back gauging. Incorporated also is the Strippit system of self-stripping punch assemblies and die buttons, rapidly changed from size to size. Strippit accessories offered include the Duplicator, Microbar assembly, and the Dupl-O-Scope.

Wales-Strippit, Inc., 204 South Buell Rd., Akron, N.Y.

Use postpaid card. Circle No. 84

Heavy Duty Blade Added To Clemson Star Line



A new Duraband saw blade, made of abrasion and heat resistant alloy steel, has been added to the Clemson Star Line of metal cutting tools.

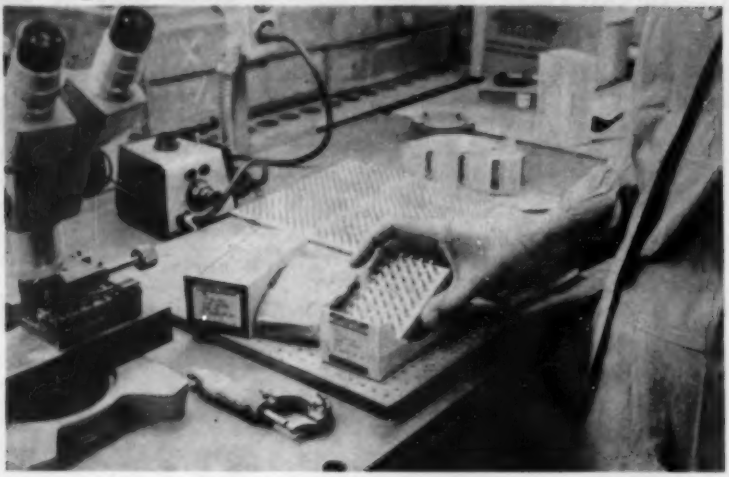
The heavy duty blades are said to lower production costs by reducing cutting time and lowering frequency of blade changes. The blades are designed for the high-pressure speed and feed of standard sawing equipment, and can be used on both standard and heavy duty band saws.

Blades are cut to the length specified by the purchaser. Widths are ¾"x.032" and 1"x.035".

Clemson Bros., Inc., Middletown, N.Y.

Use postpaid card. Circle No. 85

Miniature Precision Mounted Grinding Wheels Provide High Performance on Long Runs



A new line of miniature precision mounted grinding wheels, known as Minigrind mounted wheels, has been developed. These abrasive wheels, as small as .036" diameter and as thin as .016", were developed for use in miniature precision bearing manufacture. Additional applications are being found in the tool and die industry, specifically on jig grinders.

Entirely new mixing, molding, and mounting techniques had to be developed in the manufacture of these tiny mounted wheels. They are so thin that the wall thickness is only the width of a few abrasive grains.

Because of the extremely small diameters, these wheels must rotate at extremely high speeds to insure proper grinding action. Even at 100,000 to 150,000 revolutions per minute of the ultra high speed spindles on the machines using these wheels, the surface feet per minute of the wheel sometimes gets as low as 1000. Normal grinding speed for conventional grinding is about 6500 sfpm.

The manufacturer points out that performance of the wheels on long production runs has often exceeded original expectations, with grinding ratios (stock removal to wheel wear) in some instances being exceptionally high. He cites the following as an example: On a .055" (finished diameter) bore grinding job, over 500 races have been ground with a single mounted wheel, removing .002" to .003" from the inside diameter. This represents a total stock removal, per wheel, of more than 1". This is a tribute to the sharpness and strength of the abrasive section, considering the fact that there is only .010" of usable abrasive on the wheel.

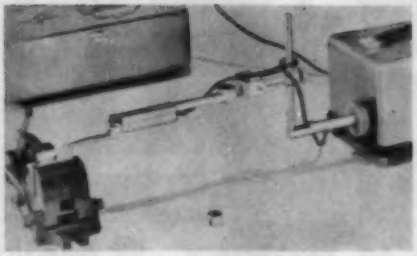
Typical specifications of these small wheels are A320-TVM for bore grinding and A320-MVG, No. 22 treated, for ball race grinding. The No. 22 treatment contributes to better finish and longer wheel life. The correct wheel specification for a specific job depends upon the material to be ground, its hardness, the work size, and stock removal.

Norton Co., Product Engineering Dept., Worcester 6, Mass.

Use postpaid card. Circle No. 86

Chisel Point Adapter For Surfindicator Unit

A new adapter for the Surfindicator (unit for measuring surface finish) has a chisel point which permits surface measurements of cutting edges, knife edges and components with very small outside diameters such as coil winding wire. Designated Model BL-130, the adapter is an accessory to the General Purpose Pickup of the Brush Surfindicator BL-110. As illustrated, it is designed for use with Brush Motor Drive BL-117.



With the unit inserted in the pickup, radii from zero (dead sharp) to ½" can be measured for surface roughness in the range from zero to 1000 micro-inches.

Brush Instruments, Div. of Clevite Corp., 37th and Perkins, Cleveland 14.

Use postpaid card. Circle No. 87

Self-Flushing Coolant Filter

A new self-flushing coolant filtering unit, the Dundick Imperial, employs a special filtering aid compound which is added to the coolant. This additive forms an open, porous "cake" on the filtering elements. As a result, foreign matter down to one micron is effectively trapped. The purified coolant, however, passes freely through.

Flushing chamber aids self-flushing without contaminating filtering elements. Filter is recharged with new filter aid each day.

Dundick Tool Works, Inc., 3410 W. 31st St., Chicago 23.

Use postpaid card. Circle No. 88

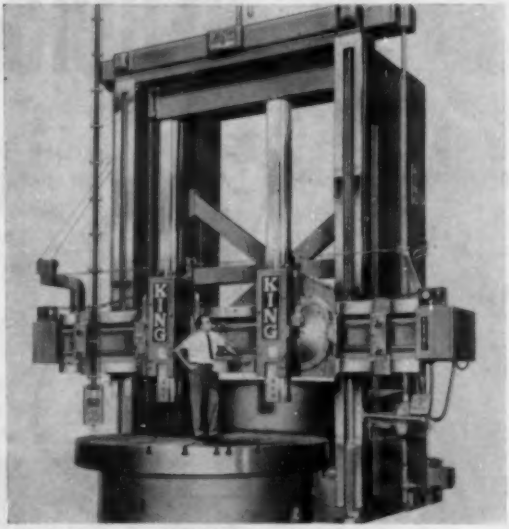
144" Boring Mill Has Full Electrical Control

The King Electrol 144" vertical boring and turning machine illustrated, custom-built to the user's requirements, features full electrical control, increased height under rail—188", double ball-bearing track, and extra-heavy duty rail and rail heads.

Among other features which can be added to King Electrol fully electrically controlled machines are: automatic feed stops, ultramatic programming, automatic tracing control of heads, and power indexing of turrets.

Machines are available in sizes 30" to 144" and up.

American Steel Foundries, Cinci. 29.



External Gear Deburring

The Model 36 machine is designed to deburr and chamfer large spur, helical, worm and bevel gears as well as splines. It operates on the same principle as the Redin Model 20 machine. A floating wheel spindle automatically follows the contour of the tooth. No wheel dressing, change gears or followers are required.

The Model 36 will handle external

A 34½" diameter steel gear, weighing approximately 1250 lbs., is being loaded on the machine. This gear was deburred in a time cycle of two minutes per side.

gears up to 36" and internal gears to 32" pitch diameter. The work spindle will handle a load of over one ton.

Redin Production Machine Co., 2433 20th St., Rockford, Ill.

Use postpaid card. Circle No. 90

3-DIMENSIONAL CAM is designed to insure balanced as well as uniform fuel control under exacting requirements. It was necessary to use a non-corrosive metal because the cam operates submerged in a contaminable solution. Metal is also distortion-free. Tolerance of ±.0005 is reported. Blanks for the special machines used in the cam's manufacture are cut from 1¾" stainless steel bar stock, allowing for a large 1.5103" dia. to a small .164" dia. Eonic, Inc., 464 E. Hollywood, Detroit 3, Mich.

Use postpaid card. Circle No. 91

Most Drilling Per Dollar!

Veet 3 foot RADIAL

Features Found Only In Highest Priced Radials

Finger-Tip Clutching
Automatic Drill Ejector
Push Button Elevation
Centralized Controls
Hardened Column & Way Inserts
Automatic Depth Control
Timken Bearing Column & Spindle
Head Glides on Ball Bearing Rollers

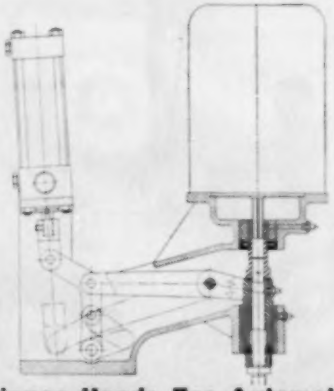
Send for Brochure of Veet's 16 Points of superiority and name of nearest dealer, who will arrange actual demonstration of the Veet Radial, in your plant, without obligation.

Refer to Thomas Register or Hitchcock's Machine & Tool Directory for further information.

Veet INDUSTRIES

Mfrs. of the VEET High Pro '30' SPEEDMILLER for Planer Conversion

Use postpaid card. Circle No. 356



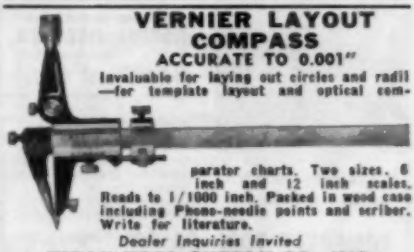
Spinner Heads For Automation

Air operated, motor driven rivet spinner heads, designed for automation, are self contained units. A clean sweep under the mounting pad allows them to be set up with dial feeds, or other ways required for automatic assembly.

Model E has capacity for ⅛" dia. rivets; Model G, 5/16" dia. rivets.

High Speed Hammer Co., 313 Norton St., Rochester 21, N.Y.

Use postpaid card. Circle No. 92



VERNIER LAYOUT COMPASS

ACCURATE TO 0.001"

Invaluable for laying out circles and radii —for template layout and optical comparator charts. Two sizes, 6 inch and 12 inch scales. Reads to 1/1000 inch. Packed in wood case including Phono-needle points and scriber. Write for literature.

Dealer Inquiries Invited

TITAN TOOL SUPPLY CO., INC.

1419 Hertel Ave. • Box T • Buffalo 16, New York

Use postpaid card. Circle No. 357

Triple Spindle Drilling, Tapping & Threading Machine

A new high speed fully automatic triple spindle machine speeds production of secondary operations on screw machine and headed parts, die castings, stampings, and molded plastic parts.

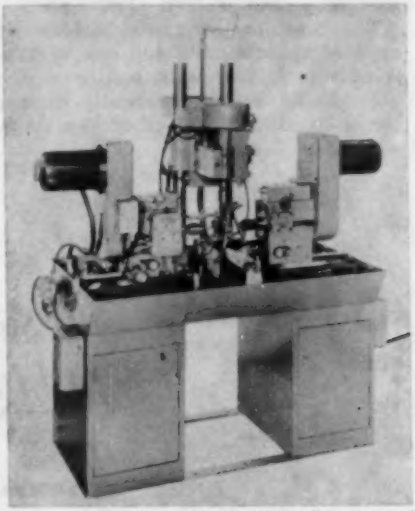
The machine has two horizontally opposed spindle units and one vertical spindle unit. Each unit can be cycled individually and automatically, in any combination with the other two units, allowing varied sequence to suit the job.

Each unit has an individual spindle drive motor with speeds ranging from 500 to 10,000 R.P.M., thus enabling each spindle to run at the proper speed for the operation being performed. Dovetail mounting permits 11" major adjustment of individual heads plus 2½" of spindle stroke control.

Capacity of .020" to ⅜" drilling and/or

up to ⅜" tapping in mild steel is offered.

Clamping fixture air outlet, pressure regulator, gauge and fixture synchronizing stations employing plug-in jacks are also provided.



The machine has two horizontally opposed spindle units and one vertical spindle unit.

With the addition of hopper and chute, this triple spindle machine can be run fully automatic, or automatic with hand fed magazine which permits operator to feed parts continuously during the entire machine operating cycle.

Universal-Automatic Corp., 9545 Ainslie St., Schiller Park, Ill.

Use postpaid card. Circle No. 93

Carbide Router For Highly Abrasive Materials

A custom designed, solid carbide rout-o-mill is said to meet the need for a tool to hold up to the abrasive qualities of materials such as Fiberglas, Milamene, Plexiglas, laminated plastics, epoxys, and similarly highly abrasive materials. It is now possible to mill, rout, trim, drill, ream, grind, and saw these modern compounds with the tool.

Dixie Tool Industries, Inc., Bridgeport, Mich.

Use postpaid card. Circle No. 94

General Purpose Superfinisher

A new Gisholt Masterline 51B general purpose superfinisher was designed with the highest flexibility in mind. The simple bed is closed on three sides but is open on the front for easy access to the lubricating pump.

Mounted on the bed are a headstock,

To this basic machine can be added a second vertical platen to permit superfinishing as many as four different areas simultaneously.

a tailstock and a vertical platen. Both the tailstock and the vertical platen are mounted in "T" slots for easy positioning along the bed. The platen is furnished with a self-contained reciprocating unit on which can be mounted either one or two stone-carrying quills. Work is held between centers in a chuck, a collet or a fixture, or supported on rollers.

To this basic machine can be added

a second vertical platen to permit superfinishing as many as four different areas simultaneously.

For work that may require positioning of the upper head for ease of loading and for I.D. work, a means for moving the stone quill 4" longitudinally can be provided. This, along with all other machine functions, is incorporated in the completely automatic machining cycle.

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

Use postpaid card. Circle No. 95

Seal-Less Coolant Pump

Newest in the Gusher line of pumps is the seal-less Model 9-P3 pump. It

is a flange mounted type with one internal and two external discharges, right- and left-hand respectively. The pump is primarily designed for machinery having comparatively shallow reservoirs.

The pre-lubricated ball-bearing

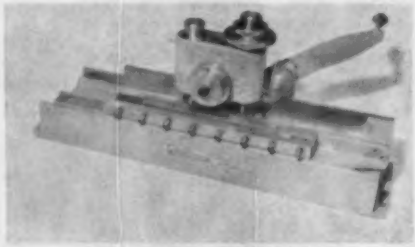
motor is 1/10 hp. The pump develops a maximum pressure of 10 p.s.i.g. and the capacity is four gallons per minute at 9 p.s.i.g. and 27 gallons per minute at one p.s.i.g.

Ruthman Machinery Co., 1800 Reading Rd., Cincinnati 2, Ohio.

Use postpaid card. Circle No. 96

Marking & Graduating Machine

A new precision graduating and marking machine has been announced



Marks all parts up to 6" dia.

for the graduation and marking of all circular graduated machine tool dials, micrometer spindles, and other precision parts. It is claimed to mark all parts up to 6" diameter, allowing very accurate positioning and indexing.

Inexpensive tooling and make-ready is introduced by use of a simple adaptor for mounting same in relation to the piece to be marked or stenciled.

Unit measures 21½"x6"x9", and sells for $245 f.o.b. Minneapolis.

Dayton Rogers Manufacturing Co., 2824-13th Ave. So., Minneapolis 7.

Use postpaid card. Circle No. 97

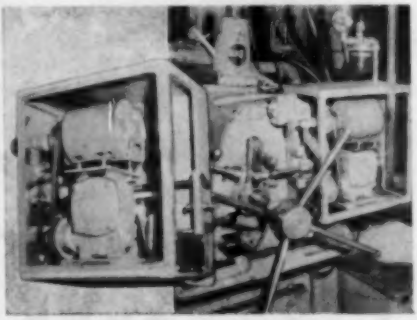
Pipe Bending Degree Indicator

The No. 1807 pipe bending degree indicator quickly and accurately indicates degree of bend on any ½" to 6" dia. pipe. It fits any hydraulic pipe and conduit bender operating in a horizontal position. Time-consuming, on-the-job figuring is reported to be eliminated and pipe need not be removed to determine the degree of bend. Large sweep bends may be completed easily by following instructions supplied with the scale. Greenlee Tool Co., 2136—12th St., Rockford, Ill.

Use postpaid card. Circle No. 98

Infeed Attachment Speeds Accurate Centerless Grinding

It is claimed the new automatic Lo-Die centerless grinder infeed attachment offers the utmost in precision grinding and duplicate sizing with a wide, variable feed rate of 12 to 40

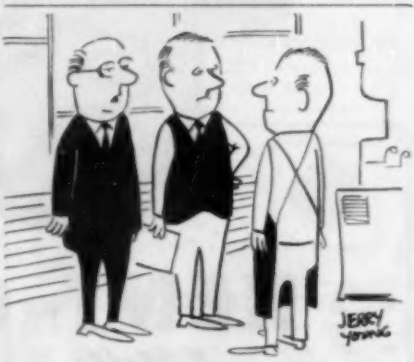


pieces a minute depending upon the tolerance and finish desired.

The attachment has positive mechanical construction and is driven by a ¼ hp, 220 volt, three phase motor, which is reported to do away with any hydraulic drive action and eliminates the need to check oil levels, cylinders, etc. Parts are air-ejected after grinding, allowing the operator to devote his attention to loading only.

Lordstown Tool and Die Co., Inc., Warren, Ohio.

Use postpaid card. Circle No. 99



"You'll soon find we're all just one big happy family. You'll be working for—what's his name—here."

Counterbores Suit 1960 Series Socket Head Screws

Operator fitting 7/8" diameter counterbore in holder using newly introduced set.

The No. 1B Standard Tool Room Set contains a set of counterbores to suit screw heads No. 6 through 5/8" diameter together with necessary pilots and holders. Three countersinks for 60°, 82° and 90° included angle are also provided.

The latest "1960 Series" socket head cap screws are manufactured in most cases with larger head diameters.

The original Continental No. 1 Standard Tool Room Set will be continued.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Use postpaid card. Circle No. 100

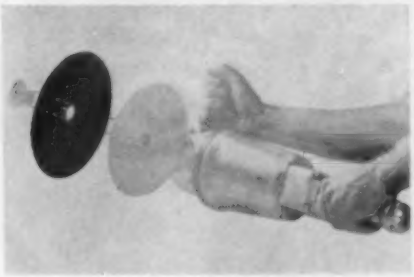
SPRING WINDING ATTACHMENT. Helios Springwinder produces precision coil springs from round and square wire. It can be used manually in a vise for smaller wire sizes. It attaches easily to any lathe. Once set, it duplicates any number of springs with close tolerances. Model No. 1 covers wire sizes, .008" to .060"; Model No. 2, .020" to .200"; Model No. 3, .080" to .600". Collins-Faust Co., 18 Park End Place, Forest Hills 75, N.Y.

Use postpaid card. Circle No. 101

Stronger Disc Center Holes Improve Surface Finishes

Better surface finishes are said to result from using RED COAT Resin Fibre discs. An improved manufacturing process strengthens disc mounting holes that minimizes the appearance of "intra-oscillating" effects during the disc working cycle.

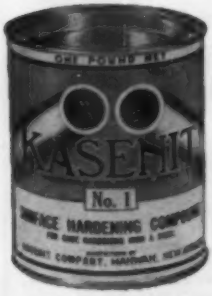
The improved discs are available in standard industry sizes ranging from



5" to 9⅛" in diameter. Center mounting holes are standard ½" and ⅞". The discs are manufactured with aluminum oxide abrasive and a variety of grit sizes ranging from 150 and coarser for heavy duty cutting. Full or spaced coating is optional in 36 grit and coarser depending upon the user's requirements.

Michigan Abrasive Co., 11900 E. Eight Mile Rd., Detroit 5, Mich.

Use postpaid card. Circle No. 102



SPEEDY-SAFE NON-POISONOUS CASE HARDENING

Indispensable for Tool Rooms, Machine Shops, Schools, etc. Now available in 1, 5, 10, 25, 50 and 100 lb. containers.

Write for Free Catalog

KASENIT CO.

Est. 1912

1 King St., Mahwah, N.J.

Use postpaid card. Circle No. 417

How to cut a keyway in 1 minute with a *Minute Man*® keyway broach kit

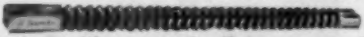
MINUTE MAN KEYWAY BROACH KITS come complete with broaches, bushings and keystock. For keyways from 1/16" to 1" in any bore from ¼" to 3"

1. Select the right size bushing for the bore (sizes are plainly marked).

2. Insert the right size broach in the bushing slot.

3. Place under an arbor press and press through.

SAVE TIME WITH STANDARD STOCK SQUARE BROACHES



Starting with a round pilot you can finish an accurate square hole in one pass in less than one minute. For 1/16" to ¾" holes. Hexagon and round broaches available.

The duMONT CORP., Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST T describing Square, Round and Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

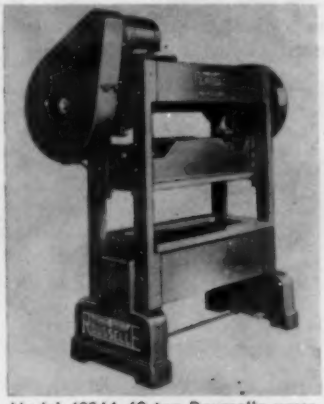
Company.....

Address.....

duMONT

Straight Side Double Crank Presses

The design of this 40-ton Rousselle press is said to make it ideally suited for handling wide rolls or sheets of stock including plastics, paper, leather and sheet metal. Four long ways provide a rigid four corner ram support



Model 4SS44 40-ton Rousselle press.

making it adaptable for steel rule dies and a variety of multiple punching.

The unit is available in three sizes with bed areas up to 6'. Standard die space is 12" but this can be increased up to 24". Units can be equipped with electrically controlled "Econo-Air" friction clutch to provide rapid, shockless starting and stopping at higher speeds.

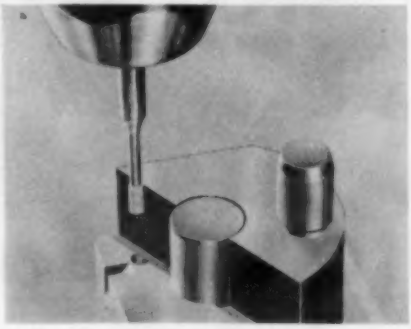
Service Machine Co., 2310 W. 78th St., Chicago 20, Ill.

Use postpaid card. Circle No. 103

Diamond Mandrel Grinds Holes Of .022" Diameter

Precision grinding of small diameter holes in all types of material can be done rapidly with a new diamond mandrel. The shanks are hardened and ground to a very close limit. Diamonds are mounted under controlled atmospheric conditions by a patented new electronic method.

Holes as small as .022" can be successfully ground accurately and rapidly.



In addition to their wide usage on jig grinding equipment, the diamond mandrels are used for precision internal grinding. They are ideal for carbide drawing and header dies.

A complete range of sizes from .018" to ¾" diam. is offered.

Precision Diamond Tool Co., P. O. Box 274, Elgin, Ill.

Use postpaid card. Circle No. 104

Mounted Wheels And Points

Dayton Safety mounted wheels and points are a specially developed line of abrasive products designed for most portable hand grinder applications. This new product line, available in standard A, B and W shapes and sizes, is now being offered by the Simonds Worden White Co.

All Dayton Safety mounted wheels and points are furnished in four different bonds, and in a variety of grain

sizes from coarse to very fine. The new Fibrasive wheels and points, manufactured of abrasive grains, cotton fibers, and rubber resins, are recommended for finish grinding of plastic molds, dies, and precision parts.

Rubber bonded wheels and points are recommended for high finish requirements in die and mold polishing, and finish grinding of stainless steel welds. Resinoid bonded wheels and points are recommended for standard grinding of stainless steel welds and snagging work on ferrous and nonferrous casting. Vitrified bonded wheels and points are recommended for general all-purpose use where open structure free cutting wheels are required.

Simonds Worden White Co., 1101 Negley Place, Dayton 7, Ohio.

Use postpaid card. Circle No. 105

Temporary Marking, Water-Removable Ink

Water Off Ink is announced for use where markings are temporary and later removed. It is easily removed by rinsing. The ink has good adhesion to metals and plastic. The company affirms it is non-corrosive to metals and does not etch metals and most plastics.

Application is by means of rubber stamps and ordinary ink pads. It can be used in felt-tipped pens and certain types of printing machines—those using fluid inks.

Colors available are white, black,

blue, purple, red, green, brown, yellow, and orange.

The ink is also offered in a low-cost disposable pen.

Organic Products Co., P.O. Box 428, Irving, Tex.

Use postpaid card. Circle No. 106

ALLOY STEEL BAND-SAW BLADE. The new Lenox Master-Band is reported to produce at a much faster cutting rate on the average cut. Other advantages claimed are that it is effective on tough steels that other blades cannot cut, and outlasts from four to eight ordinary carbon blades. It is designed both for standard band-saw machines and for automatic cut-off machines such as DoAll, W. F. Wells, Peerless, etc. American Saw & Mfg. Co., Springfield, Mass.

Use postpaid card. Circle No. 107

This new MORRISON KEYSEATER can make money for you

Install it in your shop. Its low cost will amaze you. Watch it pay for itself. You can quickly eliminate costly production tie-ups caused by waiting for expensive outside services. This is not an ordinary keyseater. The Morrison Keyseater is quality built with machine tool accuracy. Practically anyone can operate it. It has automatic feed, automatic stop to cut off feed at given depth, automatic relief to back the work away from cutters, automatic lubrication. NO BUSHINGS REQUIRED. Cuts keyways 1/16" to 1". FREE new catalog 714-A shows all features and specifications can be had by writing:

THE D. C. MORRISON CO.
P.O. Box 1017C
Cincinnati 1, Ohio

Use postpaid card. Circle No. 389

Every Shop Should Own One

No distortion — even on ⅛" stock!
MODEL "C"

KNURLMASTER Hand Knurler

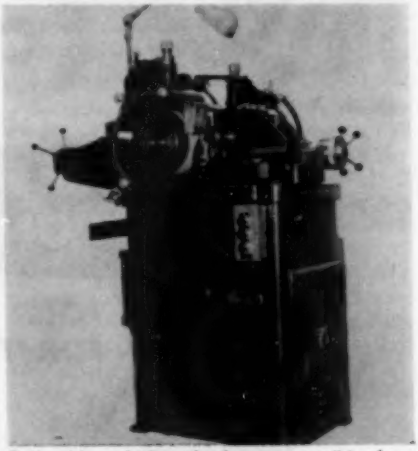
For small production runs on ⅛" to 1" stock. Exclusive screw design gives perfect knurl pattern. Furnished with 3 hardened straight or diamond pattern knurls of standard ½" dia. Forged steel frame is self-centering. Write for illustrated folder.

ROCKWIN MANUFACTURING CO.
80-C Magnolia Ave. Westbury, L.I., N.Y.

Use postpaid card. Circle No. 390

24" x 48" Centerless Grinder Wth Permanent Crush Dresser

The CG-12 high precision, centerless grinder has a permanently mounted crush dresser designed for thrufeed, plunge feed and infeed. It is 24" x 48", including coolant tank. The model grinds multiple diameter parts and intricately shaped profiles. It can grind



Both sides of the wheel are accessible from the operating position.

a variety of materials such as tungsten carbide, stainless or carbon steel, glass or plastic to .0002 or six or eight micro finish. Wood, non-ferrous metals, fibre, hard rubber, ceramics, and cork can also be ground.

Royal Master Grinders, Inc., 272 Highway 23, Riverdale, N.J.

Use postpaid card. Circle No. 108

BALANCED ALLOY LEAD HAMMERS

HANDLES AND MOULDS

1, 1½, 2½ and 5 lb. sizes—order your alloy lead hammer requirements from your mill supply house.

or direct from:

KITZMAN MFG. CO.
Manufacturers Of Lead Hammer Products
15061 Hartwell Ave. Detroit 27, Mich.

Use postpaid card. Circle No. 391

Nut Setter Handles Work Up to ⅝" Bolt Size

Air-operated Size 808 Impactool is claimed to offer 20% more power, 200% faster rundown. Handles work up to ⅝" bolt size. Tool is 2¼" shorter than the tool it supersedes, is only 7¼" long, weighs only 8⅞" lb. It delivers 1100 impacts per minute, with speed of 6000 rpm. Tool's square driver measures ⅝" across flats; ¾" and ½" sizes also. 3", 6", 8" extended anvils with ⅝" square drivers are offered, also quick change anvils for screw driver bits and socket drivers having 7/16" and ⅝" hex shanks.

Ingersoll-Rand Co., 11 Broadway, N.Y. 4.

Use postpaid card. Circle No. 169

Prints Designs In Color

Printer No. 588, chain driven and air powered, was specially developed for printing designs and decorations in color on brazier bowls for outdoor charcoal barbecue outfits.

The printed design or motif is that of "cattle brands." Due to the rolled flange and size of the product, it was not possible to use any standard type of machine. This one was constructed to clear the flange at loading, then to

move into printing position as air valve operating pressure is released.

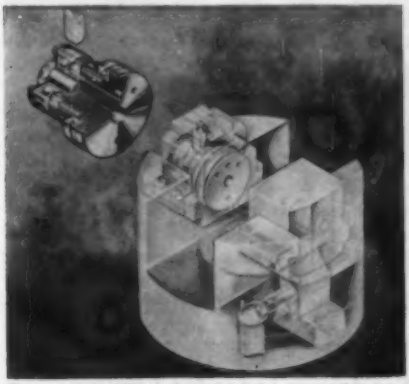
Designed to handle 24" and 18" diameter covers and print up to 1" high characters, it can be adjusted for smaller cover printing at slight extra cost.

The Acromark Co., 15 Morrell St., Elizabeth, N.J.

Use postpaid card. Circle No. 110

Chuck Jaws Freely Index Under Full Pressure

A new, heavy-duty power chuck has jaws that freely index under full pressure. Available in body diameters from 12" through 36", and in all intermediate dia., the new chuck development lets operator index manually without touching work or releasing pressure. Jaws can be indexed simply and fast by means of a lock screw and slide plate.



This design eliminates need for more than one chuck—index jaws or index components can be interchanged quickly.

One or both jaws can be furnished with indexing mechanisms. As a result, the operator can index more positions and smaller index angles. This design eliminates the need for more than one chuck—index jaws or index components can be interchanged quickly and easily.

Dept. IC-4, The Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

Use postpaid card. Circle No. 111

Pre-Honed Disposable Inserts

G-E's Metallurgical Products Dept. announces it is now ready to supply Carboloy® pre-honed disposable inserts in any quantity and in most standard grades. It is reported that extensive tests in actual production show that these inserts have about 35% longer predictable tool life than unhoned inserts and are substantially better than hand honed. In addition, pre-honing makes it possible to use harder, more durable grades. Grades formerly only used on finishing may be used in semi-finishing when pre-honed. Grades earmarked for semi-finishing may be used in roughing.

Pre-honed inserts also cost less than unhoned inserts plus hand honing.

Metallurgical Products Dept., General Electric Co., Detroit 32.

Use postpaid card. Circle No. 112

Lead-Screw Tapping Spindles

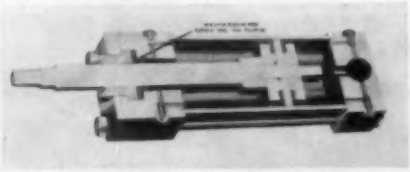
Lead-screw tapping spindles, having the same sleeve diameters as standard slip spindles, have been developed. Made in all sizes of nose O.D.'s from ⅞" to 3", these spindles are of compact design with accurate leads for cutting uniform threads.

Machines arranged for drilling and tapping operations and equipped with jig-bored cluster plates for standard slip spindles can use these new lead-screw tapping spindles, simply by substituting them for the slip spindles. Extra plates are not required.

Seibert & Sons, Inc., Chenoa, Ill.

Use postpaid card. Circle No. 113

New Rod Seal Design For Air Cylinders



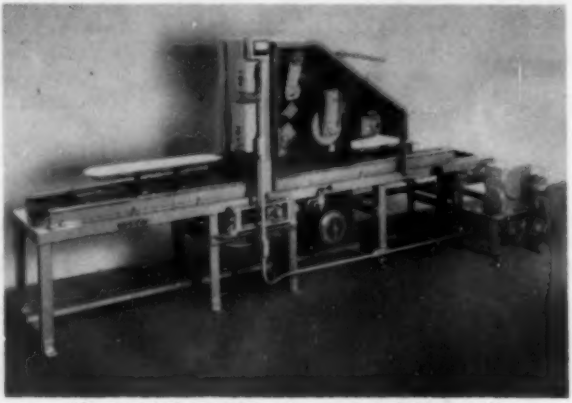
The Miller Fluid Power Div. of Flick-Reedy Corp. now offers its air cylinders with its new "Sta-Dyn" piston rod flange seal designed to simplify and speed up cylinder assembly and rod seal field replacement. The new seal combines the rod flange seal with the rod bushing sealing ring into a single, simple one-piece unit, thus completely eliminating one assembly operation.

Miller Fluid Power Div., Flick-Reedy Corp., York and Thorndale Rds., Bensenville, Ill.

Use postpaid card. Circle No. 114

Abrasive Belt Head For Grinding Convex and Concave Surfaces

A new abrasive belt head has been designed for grinding and polishing convex or concave surfaces of aluminum, brass, and steel castings. This is reported to considerably shorten time required to buff convex and concave surfaces—a job formerly done by hand. A specially designed air operated scanning eye prevents belt run-off, providing a heavier cut to be taken with fewer passes necessary. As the abrasive belt oscillates, tension take-up is air controlled.



Air operated scanning eye prevents belt run-off.

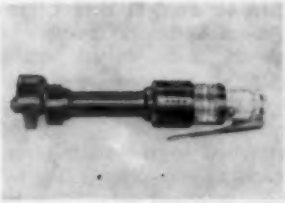
Murray-Way Corp., Birmingham, Michigan.

Use postpaid card. Circle No. 115

Small Horizontal Grinders

Only 10" long and weighing 40 oz. are the 31G-520 (shown) and -720 grinders. Used principally for die grinding, but well-suited for deep hole grinding and may be adapted for use with rotary files, cutters and midget mills. Both tools operate at 20,000 rpm, require ¼" ID hose and 90-100 psi pressure, have 1-5/16" OD front heads, and accept a max. 1¾" organic wheel. The -520 has a lever type throttle; the -720, a lock-button. Accessories offered. Price, $135.

Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1.



Used for die grinding.

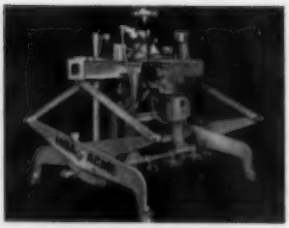
Use postpaid card. Circle No. 116

Sheet and Billet Lifter

Combination sheet and billet lifter handles single sheets, slabs, billets or ingots. Multiple vacuum cups or scissors tongs are used as required. The tong action is automatic and the face of the material being handled is protected by supporting rollers attached to the tong arms. Frame supporting the vacuum cups is actuated by air cylinders controlled by a solenoid valve. The lifter incorporates its own vacuum system including motor, pump and vacuum reservoir. Sizes and capacities made for customer.

The Hill Acme Co., 1201 W. 65th St., Cleveland 2.

Use postpaid card. Circle No. 117



Unit illustrated has tong cap. of 8,000 lb., vacuum lift cap. of 1,200 lb., both with adequate safety factors.

End Mills for Machining Hard Abrasive Materials

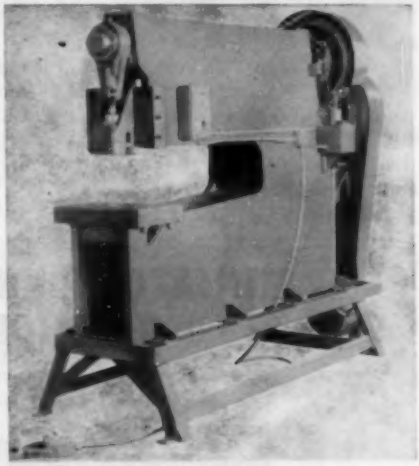
This vanadium high-speed steel single-end end mill is one of a new standard line offered by The DoAll Co. for machining abrasive or tough materials Rc 30-40. The end mills are standard in 2, 3, 4 and 6 flutes from 3/8" through 2" diameter. The company has also added to its end mill line four flute center cutting, miniature sizes starting at 1/32" dia., keyway and large diameters 2" and over with Sure-Lock shanks.

The DoAll Co., Des Plaines, Ill.

In 2, 3, 4 and 6 flutes from 3/8"—2" dias.

Use postpaid card. Circle No. 118

Heavy Duty Power Punch Press Has 40 Ton Cap., 36" Throat



Electric foot button leaves operator's hands free to work the material.

An electrically operated heavy duty power punch press has been developed, with 40 tons capacity and 36" throat. The advantage of the throat depth is that it is completely usable, as no limiting tie-bars or other devices are needed.

Featured also is a solenoid operated, pin-type, non-repeat clutch which can be easily converted to repeat. Use of the electric foot button leaves the operator's hands free to maneuver the material. If desired, a hand operated push button can be installed.

Electric motor is available in 220-440 or 550 volts with 60 cycle current. Throat height is 12" with 84 strokes per minute.

The hole in the ram accepts punch and die sets with 2" shanks. Smaller punch shanks can be used by employing bushings or punch holder adapters.

Whitney Metal Tool Co., 724 Forbes St., Rockford, Ill.

Use postpaid card. Circle No. 119

Hole Drilling Tapping Screw

An improved hole drilling tapping screw, called "Tapits," drills its own hole and forms its own thread. Integral washer with serrated face acts as a brake in minimizing stripping.

The screw is driven with a quarter-inch power screw driver with adjustable clutch. A magnetic driver socket supplied fits any standard power driver. Only one size socket is needed, since all sizes of screws, from No. 6 to No. 10, have same size hex head.

Parker-Kalon, Clifton, N.J.

Use postpaid card. Circle No. 120

14 don't overlook these features

- **How To Keep From Slowly Going Broke** is aired by Harry Conn in his interesting column. The secret lies in Industrial Economics, a subject which is presented here in a new manner, short and to the point. **Page 87**

- **Hacksaw Blades—Their Proper Selection And Use Can Save You Thousands** and can make any job easier and more pleasant, says Engineering Editor Darrell Ward. One of man's oldest cutting tools, there is much about them that is little known. **Page 109**

- **Avoiding Distortion In Sheet Metal Parts** is the problem tackled this month by Allan Young. Key to the problem's solution lies in the sequence in which tools are used. **Page 102**

- **Trend In Transfer Equipment** is described in a special report from our Engineering Editor, Darrell Ward. The trend is to standard machine components on a line, but when tracer control is added new horizons unfold. **Page 130**

The MARKET PLACE

Advertisements acceptable in THE MARKET PLACE include those for employment, sales services, production facilities, representation and related needs. **Rates: $20 per column inch per insertion. Maximum size advertisement accepted in this section is three inches.**

Copy should reach us by the first of the month for next month's issue.

"When are you going to do something about the light in here?"

15

products index

16

index to advertisers

A

B

C

D

E

THE 18" SPEEDLAP

Exceptionally well suited for smaller parts (1/16" to 6¾" O.D.) such as silicon semi-conductors, valve discs, spacer washers and hearing aid components including parts as thin as .003". Has 143 square inches of working area available with capability of removing 1.43 cubic inches of material* per hour.

* FREE MACHINING METAL

THE 32" SPEEDLAP

Excellent for handling intermediate size parts (½" to 12" O.D.) like compressor plates, pump rings, die castings and seal plates; also parts to .010" minimum thickness. Provides 450 square inches of useable working area with a stock* removal rate of 6.75 cubic inches per hour.

* FREE MACHINING METAL

THE 48" SPEEDLAP

Accommodates large parts (½" to 18" O.D.) or an extremely high volume of small parts. Applications include pump housings, small cylinder heads, valve plates, meat chopper discs, etc., and myriad small parts in quantity. Working area covers 1050 square inches. Unit is capable of removing 26.25 cubic inches of material* per hour.

* FREE MACHINING METAL

SPEEDLAP

removes stock faster than most grinders—accurate to within millionths of an inch. Materials range from the ceramics and silicons through the steels (including stainless) as well as castings and die castings . . . Larger size machines on special order.

Use postpaid card. Circle No. 408

Ask for free cost and production estimates based on samples or prints of your parts. Job lapping service also available.

PHONE ORchard 6-1500 or write:

SPEEDLAP CORPORATION
8022 N. Monticello Avenue
Skokie, Illinois

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Y

Sid Tool Company

WHY WAIT FOR SPECIAL TAPS?

. . . Has them IN STOCK for IMMEDIATE DELIVERY!

HIGH SPEED SPECIAL RIGHT HAND TAPS

SIZE	THREAD
00	96
0	70-72-78-80
1	48-56-64-72-80-90
2	48-52-56-64-72-80
3	40-44-48-48-56-60-64
4	32-36-40-48-56-60-64-72-80
5	30-32-36-40-44-48-56-64-80
6	30-32-36-40-48-56-60-64-72-80
7	30-32-36-40-48-64
8	24-30-36-40-44-48-56-60-64-80
9	24-28-32-36-40
10	28-30-36-40-48-56-60-64
12	20-22-24-28-30-32-36-40-56-60
14	20-24-28-32-40
1/16	60-64-72
5/64	72
3/32	36-48
1/8	32-36-40-44-48
5/32	32-36-38-40-44-48
3/16	20-24-28-32-36-40-48
7/32	20-24-28-32-36-40
1/4	14-16-18-22-24-26-27-28-30-32-36-40-48-56-64
9/32	18-20-24-27-28-32-40-64
5/16	16-18-20-22-24-25-27-28-30-32-36-40-48-64
11/32	20-28-32-40-48
3/8	12-13-14-18-20-22-27-28-30-32-36-40-48
13/32	18-20-24-32
7/16	12-14-16-18-20-24-27-28-32-36-40
15/32	32
1/2	12-13-14-16-18-20-24-27-28-32-36-40
9/16	12-14-16-18-20-24-27-28-32-36-40
5/8	10-11-12-14-16-18-20-24-27-28-32-36-40
11/16	10-11-12-14-16-18-20-24-27-28-32-40
3/4	10-11-12-14-16-18-20-24-27-28-30-32-36-40
13/16	10-12-14-16-18-20-24-27-32
7/8	9-10-12-14-16-18-20-24-27-28-32-40
15/16	8-9-10-12-14-16-18-20-24-27-32-40
1	8-10-12-14-16-18-20-24-27-32-36-40
1-1/16	10-12-14-16-18-20-24-27-32
1-1/8	7-8-10-12-14-16-18-20-24-27-32-36
1-3/16	8-10-12-14-16-18-20-24-27-32
1-1/4	7-8-10-12-14-16-18-20-24-27-32
1-5/16	6-8-10-12-14-16-18-20-24-27-32
1-3/8	6-8-10-12-14-16-18-20-24-27-32
1-7/16	8-10-12-14-16-18-20-24
1-1/2	6-8-10-12-14-16-18-20-24
1-9/16	12-14-16-18-20-24
1-5/8	5½-6-8-10-12-14-16-18-20-24
1-11/16	6-8-10-12-14-16-18-20-24
1-3/4	5-8-10-12-14-16-18-20-24
1-13/16	8-10-12-14-16-18-20
1-7/8	5-8-9-10-12-14-16-18-20-24
1-15/16	5-8-8-10-12-14-16-18-20
2	8-10-12-14-16-18-20
2-1/16	12-14-16
2-1/8	8-10-12-14-16-18-20
2-3/16	10-12-14-16
2-1/4	4½-8-10-12-14-16-18
2-5/16	12-14-16-18
2-3/8	10-12-14-16-18
2-1/2	4-8-10-12-14-16-18
2-9/16	12-14
2-5/8	8-10-12-14-16-18
2-3/4	4-8-10-12-14-18
2-7/8	8-10-12-14-16
3	4-8-10-12-14-18
3¼	8-10-12-14-16
3½	8-10-12-14-16
3¾	4-8-10-12-14
4	8-10-12

HIGH SPEED LEFT HAND TAPS

SIZE	THREAD
0	80
1	56-64-72
2	56-64
3	56
4	32-36-40-48
5	40-44
6	32-36-40
8	32-36-40
10	24-30-32-40
12	24-28-32
1/4	20-28-32
5/16	18-20-24-28-32
3/8	16-24-32
7/16	14-20-28
1/2	12-13-20-28
9/16	12-18-20-24
5/8	11-12-18-20-24
11/16	11-16-24
3/4	10-16-18-20
13/16	16
7/8	9-12-14-18-20
1	8-12-14-16-18-20
1-1/8	7-12
1-1/4	7-12-16-18
1-3/8	6-8-10-12-16-18-20-24
1-7/16	8-10-12-14-16-18-20
1-1/2	6-8-10-12-16-18-20
1-9/16	8-10-12-16-18-20
1-5/8	8-10-12-14-16-18-20
1-11/16	8-10-12-14-16-18-20
1-3/4	8-10-12-14-16-18-20
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20
1-15/16	8-10-12-14-16-18-20
2	4½-10-12

• SPECIAL AND LEFT HAND DIES IN STOCK •

NOTE: Oversize, Undersize, Metric, 64th and 32nd Size Taps Available for Quick Delivery. We stock Special Sizes in High Speed Milling Cutters, Slitting Saws, End Mills and Reamers.

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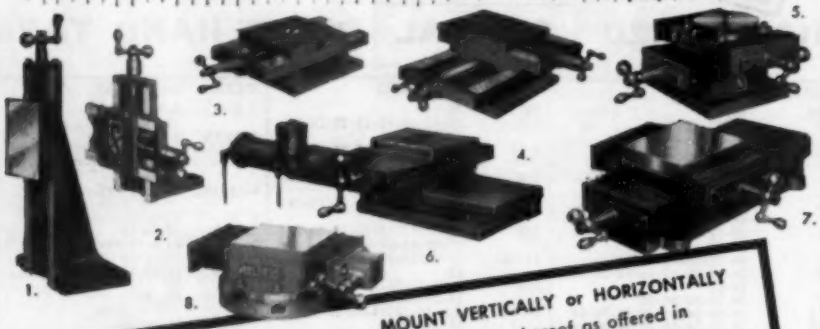

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BASE MOUNTING: Fig. 3 with Horizontal Feed. Figs. 4, 5, 6 and 7 with Compound Feeds.

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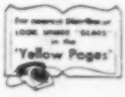

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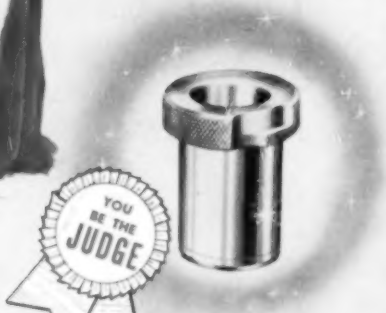

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